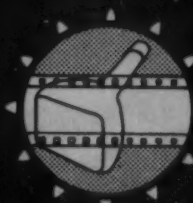


JOURNAL OF THE



SMPTE

- 875 Rapid Processing of Motion-Picture Film by the Application of Viscous Coatings —
Part I: Viscous-Layer Processing of Motion-Picture Film
• George E. Cummins, John R. Turner and Robert J. Wilson
- 878 Part II: A Machine for Rapid Processing of Black-and-White 16mm Films
• Paul A. Hermle and Harold D. Lowry
- 882 Black-and-White Television Monitoring and Video Levels — Part I: Basics of Picture
Waveform Generation and Video Monitors; Part II: Black-and-White TV Monitoring and
Video Levels • Harold Wright
- 898 Shutter-Bar in Television Film Recording • C. H. Evans
- 904 A Microdensitometer for Photographic Research • Frank P. Herrmfeld
- 906 A Storage Memorized Light-Control System • Jean De Backer
- 909 Letter to the Editor: Infrared Transparency of Magnetic Tracks • George Lewin
- 910 Proposed Standards: PH22.132, 16mm 400-Cycle Signal Level Test Film, Magnetic Type,
Perforated IR-3000; PH22.133, Screen Luminance and Viewing Conditions for 35mm
Review Rooms
- American Standards: PH22.2-1961, 35mm Photographic Sound Motion-Picture Film, Usage
in Camera; PH22.126-1961, 16mm Multi-Azimuth Test Film, Magnetic Type
- 959 Résumés — Resúmenes — Zusammenfassungen

91st SMPTE Convention • April 29–May 4 • Ambassador Hotel, Los Angeles

volume 70 • number 11

NOVEMBER 1961

JOURNAL of the SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

PUBLICATION OFFICE TWENTIETH AND NORTHAMPTON STREETS EASTON, PA.

Officers

President, 1961-62

JOHN W. SERVES, National Theatre Supply Co., 50 Prospect Ave., Tarrytown, N.Y.

Executive Vice-President, 1961-62

REID H. RAY, Reid H. Ray Film Industries, 2269 Ford Parkway, St. Paul 16, Minn.

Past-President, 1961-62

NORWOOD L. SIMMONS, Eastman Kodak Co., 6706 Santa Monica Blvd., Hollywood 38, Calif.

Engineering Vice-President, 1960-61

DEANE R. WHITE, Photo Products Dept., E. I. du Pont de Nemours & Co., Inc., Parlin, N.J.

Editorial Vice-President, 1961

GLENN E. MATTHEWS, Research Labs., Bldg. 59, Kodak Park, Eastman Kodak Co., Rochester 4, N.Y.

Financial Vice-President, 1960-61

ETHAN M. STIFLE, Eastman Kodak Co., 342 Madison Ave., New York 17, N.Y.

Convention Vice-President, 1961-62

HARRY TEITELBAUM, Hollywood Film Co., 956 Seward St., Hollywood 38, Calif.

Sections Vice-President, 1960-61

GARLAND C. MISENER, Capital Film Laboratories, 1905 Fairview Ave., N.E., Washington, D.C.

Secretary, 1961-62

HERBERT E. FARMER, 7826 Dumbarton Ave., Los Angeles 45, Calif.

Treasurer, 1960-61

G. CARLETON HUNT, General Film Laboratories, 1546 N. Argyle Ave., Hollywood 28, Calif.

Governors, 1960-61

MAX BEARD, 10703 East Nolcrest Dr., Silver Spring, Md.
EDWARD H. REICHARD, 13059 Dickens St., North Hollywood, Calif.
MALCOLM G. TOWNSLEY, Bell & Howell Co., 7100 McCormick Rd., Chicago 45, Ill.
W. W. WETZEL, 725 Ridge St., St. Paul, Minn.
CHARLES W. WYCKOFF, 69 Valley Rd., Needham 92, Mass.

Governors, 1961-62

JAMES W. BOSTWICK, General Motors, 465 W. Milwaukee, Detroit 2, Mich.
G. R. CRANE, 212 24th St., Santa Monica, Calif.
ROBERT G. HUFFORD, Eastman Kodak Co., 6706 Santa Monica Blvd., Hollywood 38, Calif.
WALTER I. KISNER, 123 Browncroft Blvd., Rochester 9, N.Y.
KENNETH M. MASON, Eastman Kodak Co., Prudential Bldg., Room 2006, Chicago 1
RODGER J. ROSS, 784 Dutchess Dr., Applewood Acres, Port Credit, Ont., Canada

Governors and Section Chairmen, 1961

WILLIAM H. METZGER, Ansco, 405 Lexington Ave., New York 17
RALPH E. LOVELL, 2554 Prosser Ave., Los Angeles 64, Calif.

Section Chairmen

DONALD E. ANDERSON, 1718 Valley View Ave., Belmont, Calif.
ROBERT M. FRASER, Information Technology Laboratories, 10 Maguire Rd., Lexington 73, Mass.
ERIC C. JOHNSON, 139 Tobey Rd., Pittsford, N.Y.
MALCOLM D. MCCARTY, 440 Wildwood Rd., Dallas, Texas
FRANK M. McGEARY, M-P Laboratories, 781 South Main St., Memphis 6, Tenn.
FINDLAY J. QUINN, TransWorld Film Laboratories Ltd., 4824 Cote des Neiges Rd., Montreal, Que., Canada
WESLEY R. SANDELL, Kodak Processing Lab., 4729 Miller Dr., Chamblee, Ga.
WILLIAM H. SMITH, 9930 Greenfield Rd., Detroit 27, Mich.
WILLIAM E. YOUNGS, 231 Mayflower Dr., McLean, Va.

Editorial Office

55 West 42 St., New York 36, New York

Editor—VICTOR H. ALLEN

Advertising Manager—DENIS A. COURTNEY

BOARD OF EDITORS

Chairman—PIERRE MERTZ

66 Leamington St., Lido, Long Beach, N.Y.

HARLAN L. BAUMBACH

MAX BEARD

GERALD M. BEST

GEORGE R. CRANE

HAROLD E. EDGERTON

CARLOS H. ELMER

CHARLES R. FORDYCE

LLOYD T. GOLDSMITH

LORIN D. GRIGNON

A. M. GUNDELFINGER

CHARLES W. HANDLEY

RUSSELL C. HOLSLAG

CLYDE R. KEITH

W. I. KISNER

RALPH E. LOVELL

HERBERT W. PANGBORN

BERNARD D. PLAKUN

WALDEMAR J. POCH

ALLAN L. SOREM

R. T. VAN NIMAN

DEANE R. WHITE

W. T. WINTRINGHAM

HAROLD WRIGHT

CHARLES W. WYCKOFF

EMERSON YORKE

Papers Committee Chairman—ROBERT C. RHEINECK
CBS News, 485 Madison Ave., New York 22, N.Y.

Subscription to nonmembers, \$12.50 a year (outside continental United States, add \$1.00 for postage); subscribers residing in countries which participate in UNESCO may use UNESCO coupons in submitting subscription payments in the event other means of remitting are not available; single copies, \$2.00 for one-part issues, \$2.50 for special two-part issues. A 10% discount is allowed to individual members and accredited agencies on orders for subscriptions and single copies. A list of priced and gratis publications is available. Order from the Society's Headquarters Office, 55 West 42d St., New York 36.

THE SOCIETY is the growth of over forty years of achievement and leadership. Its members are engineers and technicians skilled in every branch of motion-picture film production and use, in television, and in the many related arts and sciences. Through the Society they are able to contribute effectively to the technical advance of their industry. The Society was founded in 1916 as the Society of Motion Picture Engineers and was renamed in 1950.

Membership in Sustaining, Active, Associate or Student grades is open to any interested person according to his qualifications. Information about membership, technical activities and standards and test films for the industry is available from Society Headquarters. Members residing in countries which participate in UNESCO may use UNESCO coupons in submitting membership payment in the event other means of remitting are not available.

SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

Headquarters Office: 55 West 42d St., New York 36, N.Y. Cables: Somopict Telephone: LOngacre 5-0172

Executive Secretary: CHARLES S. STODTER

Published monthly by the Society of Motion Picture and Television Engineers. Publication office 20th and Northampton Sts., Easton, Pa. Second-class mail privileges authorized at Easton, Pa. This publication is authorized to be mailed at the special rates of postage prescribed by Section 132.122. Copyright 1961, by the Society of Motion Picture and Television Engineers, Inc. Permission to republish Journal text material must be obtained in writing from the Society's Headquarters Office, 55 West 42nd St., New York 36. The Society is not responsible for statements of contributors. Printed by Mack Printing Company, Easton, Pa.



Rapid Processing of Motion-Picture Film by the Application of Viscous Coatings

Part I: Viscous-Layer Processing of Motion-Picture Film

By GEORGE E. CUMMINS, JOHN R.
TURNER and ROBERT J. WILSON

A method has been developed for the rapid processing of motion-picture film by the application of thin coatings of viscous chemical solutions. The chemical treatments are carried out in an atmosphere saturated with water vapor at an elevated temperature. The physical and photographic quality of black-and-white positive film processed by this method is equal to that obtained from conventional processing. The chemical solutions used for these treatments maintain their properties over extended periods of storage under normal conditions. The usual problems of chemical control are eliminated, thus permitting automatic operation of the processing system.

FOR MANY IMPORTANT uses of motion-picture film, such as for television, increasing needs have been indicated for processing the film to a high standard of quality quickly and conveniently.

Familiar methods of rapid processing that might be useful for this purpose commonly employ higher temperatures, more reactive solutions and higher agitation levels than are used for conventional processing.¹⁻⁴ High agitation is usually necessary during rapid processing in order to maintain a high reaction rate and to obtain satisfactory density uniformity.

A quite different approach for rapid processing consists in the application of a coating of concentrated viscous processing solution to the emulsion surface at an elevated temperature. This method has the advantage that a replenished bath of solution is not required and the agitation factor is not present. Thus many of the usual problems of chemical and physical control of photographic processing can be completely avoided.

Processing by the application of viscous coatings has been used in several different combinations for many years. One notable example is the redevelopment of the silver image for photo-

graphic soundtrack on color motion-picture film.⁵

This paper summarizes some recent work on the rapid processing of black-and-white positive motion-picture film by the application of viscous coatings. Part II describes the design of a processing machine for this purpose. Further papers are planned to cover other phases of this work.

Viscous-Layer Treatment

This recent work has shown that motion-picture film can be developed to a high standard of physical and photographic quality on continuous machines by coating the emulsion surface with a thin layer of viscous developing solution under the following conditions:

Solution Characteristics

Solutions to be used for viscous-layer development are required to have several specific physical and chemical characteristics.

- (1) viscosity sufficient to avoid displacement of the coated layer;
- (2) chemical properties to obtain the required developed image;
- (3) concentration to permit the use of thin coatings; and
- (4) satisfactory wetting, even spreading, and no bubbles.

The subject of the physics and chemistry of viscous development is much too broad to attempt to cover in this paper, except in very general terms. Several commercial thickening agents have

proved to be satisfactory for obtaining increased viscosity of developing solutions without seriously impairing the chemical properties or diffusion characteristics.

Solutions for viscous-layer development are special formulations. The solutions are preferably formulated to a higher pH, and contain a higher concentration of developing agent than is common practice for solutions used in agitated systems. Otherwise the times required for viscous treatment would be appreciably longer. While higher pH and more concentrated developing solutions might also be used in the corresponding agitated systems, this is generally less feasible and less economical.

At a given temperature the time required for viscous development with a high-activity solution may be a little less or a little longer than for a corresponding immersion treatment with standard solutions, but the difference in time for the method described here has not been large enough to be a basis of preference for one method over the other.

The chemical economy of viscous-layer development is surprisingly favorable, especially considering that the applied coating is only partially used up on areas of low developed density. The coating thickness of 0.008 in. used in these experiments for the viscous development of Eastman Fine Grain Release Positive Film, Type 7302, corresponds to a volume of 1 ml per foot of 16mm film. For conventional processing of this film the replenisher rates are in the range from 3.0 to 12.0 ml per foot of film. An offsetting factor in the relative economy is that the viscous solutions are more concentrated. Up to the present time, the developing and fixing solutions selected for the viscous-layer processing of black-and-white positive films retain their properties within close limits for storage periods of at least six months.

Presented on May 11, 1961, at the Society's Convention in Toronto by George E. Cummins, John R. Turner (who read the paper) and Robert J. Wilson, Color Technology Div., Eastman Kodak Co., Rochester 4, N. Y.

(This paper was received on August 30, 1961.)

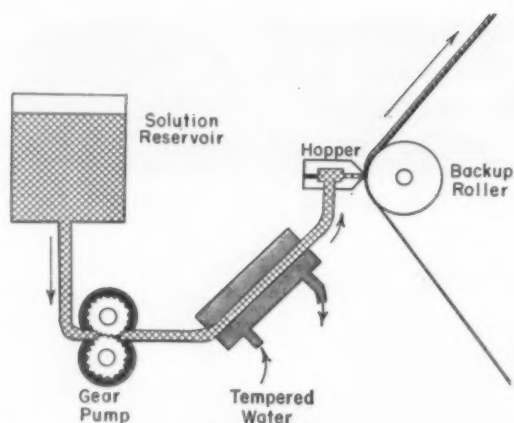


Fig. 1. Method of applying viscous solutions.

Coating Application

The selection of a suitable method of coating application is vital to the successful use of viscous-layer treatment. A method of controlling coating thickness insensitive to variations in solution viscosity is to be desired. Also a closed system to avoid oxidation and evaporation prior to coating lends itself to intermittent service. Conditions that have been found to be particularly suitable for viscous-layer application are as follows:

- (1) solution metered to the hopper at required temperature,
- (2) solution applied to the upgoing strand,
- (3) sufficient layer thickness,
- (4) hopper accurately positioned, and
- (5) uniform film travel.

In the present work a positive-displacement metering pump is used to discharge solution at a predetermined constant rate through a slotted coating device of the type termed an "extrusion hopper," shown in Fig. 1. The solution in the supply reservoir should be protected from exposure to air. A filter screen may be located between the reservoir and the metering pump, but appreciable suction at the metering pump should be avoided. The surface being coated moves upward past the hopper at a uniform rate of speed.

Conditions of Treatment

There are some important conditions to be fulfilled during and following viscous-layer development:

- (1) reaction to be carried out in air saturated with water vapor,
- (2) no mechanical disturbance of coating,
- (3) cutoff of coating with water spray jet, and
- (4) squeegee off surface water.

The reaction of the coating of developing solution with the emulsion must be carried out in an atmosphere of controlled relative humidity, since the temperature of the surface of the wet

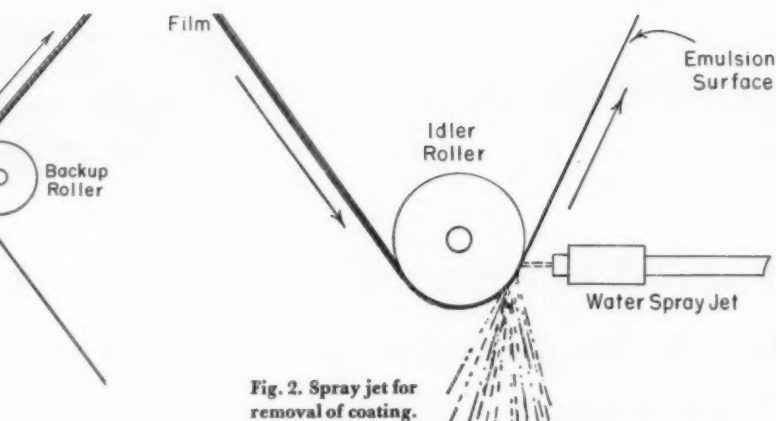


Fig. 2. Spray jet for removal of coating.

coating will approach the wet bulb value. Variations in humidity can be avoided by saturating the air in the processing chamber with water vapor at the desired temperature of treatment. Such conditioned air is readily obtained from a spray wash, or from a separate humidifier. The maintaining of a saturated atmosphere requires that the chamber be insulated sufficiently to avoid excessive condensation. It is especially important that droplets of condensate be prevented from coming in contact with the surface of a viscous coating or the emulsion surface of dry film.

The developer coating should be removed very quickly and completely in order to assure a high degree of uniformity of developed density. For the continuous processing of motion-picture film, coatings are very effectively removed by water from a flat spray jet operating at a pressure of 15 psi, and set at an angle of about 45° against the direction of motion of the film as shown in Fig. 2. The combination of hopper application and spray cutoff is very effective in providing the sharply defined treatment necessary for controlled rapid processing.

If a subsequent viscous coating is to be applied, surface water should also be completely removed, preferably by a Venturi squeegee of the type described by Ott and Lovick.⁸ After squeegeeing, viscous fixing solution may be applied in the same manner as viscous developer.

The discharge of cool, dry air from the squeegee into the processing chamber will have some effect on the temperature and humidity of the atmosphere in the developing chamber. Hence it is desirable that the volume of air used for squeegeeing be kept to a minimum.

Fixation

The advantages of fixation by the use of a viscous coating are less outstanding than those for viscous development. Fresh fixing solution is coated, allowed to react, and discarded. The

use of the viscous fix treatment to arrest development affords a very sharply defined stop action. Times for viscous fixation are somewhat longer than for immersion treatment at the present stage of the work, partly because of limitations in the thickening of highly concentrated fixing solutions. Nevertheless, viscous fixation in combination with viscous development is particularly suitable for processing facilities intended for intermittent service. The equipment can be shut down for weeks and yet be ready for startup in a very short time.

Experimental Viscous-Layer Processing of Positive Films

A temperature of 125 F was selected for the experimental viscous-layer processing of Eastman Fine Grain Release Positive Film, Type 7302, Eastman Fine Grain Sound Recording Film, Type 7373, and Eastman Television Recording Film, Type 7374. The total processing time for these films is about one minute dry to dry at the 125 F temperature, and no difficulties have been encountered with the physical behavior of the films under these conditions. The experimental work thus far has been concerned primarily with films manufactured by Eastman Kodak Co. It is anticipated that other films having similar properties can also be processed satisfactorily.

Work is also in progress on the viscous-layer treatment of reversal and negative films. This work is not yet complete and will be reported separately at a later date.

Eastman Fine Grain Release Positive Film, Type 7302

A viscous-layer process selected for Type 7302 film produced the curve shown in Fig. 3 in a developing time of 5.8 sec.; for comparison there is shown the curve for the standard conventional process for the film in Kodak D-16 developer at 70 F and a time of development of 3½ min as run in the Film Testing Division of Eastman Kodak Co. The curve for the viscous process shows slightly more speed and a sharper toe.

Pairs of reduction prints were made on Type 7302 from 35mm test negatives. These prints and also samples of Type 7302 flashed to a density of 1.0 were processed through the standard immersion process and through the viscous-layer process. Projection of the comparison films side-by-side under very critical viewing conditions indicated that the quality from the 125 F viscous process was equal to that of the standard process in density uniformity, in graininess, and in image tone. The sharpness on the screen for the viscous-layer process was judged to be just perceptibly better than for the standard process.

Complete tests of the physical characteristics of Type 7302 film run through the rapid viscous process have indicated that the results obtained are essentially identical to those for conventional treatment in all important respects including curl and scratch resistance.

The quality of photographic soundtrack on Type 7302 run through the rapid process is judged to be slightly better than that for soundtrack run through the conventional process, particularly for noise level. The reduced noise is attributable to the extreme cleanliness of the viscous-layer process and to the lesser amount of abrasion of the support because the film passes over relatively few rollers during rapid processing. It has been pointed out by J. A. Maurer⁷ that the elimination of the fine deposit often present on the emulsion surface of motion-picture film, which comes partly from developer sludge, would improve the quality of photographic soundtrack. Viscous-layer development appears to achieve this desired improvement.

Eastman Fine Grain Sound Recording Film, Type 7373

Eastman Fine Grain Sound Recording Film, Type 7373, is intended primarily for variable-density sound recording. It is also currently used for TV recording.

Viscous-layer processing trials of this film have shown entirely satisfactory results when a 17-sec fix time is used as compared to 12 sec for Type 7302.

Picture-tube exposures made by one of the major networks on Type 7373 film have been processed by viscous-layer treatment. Prints of these exposures examined on closed-circuit playback show no significant differences from prints from similar exposures run through the conventional process.

Eastman Television Recording Film, Type 7374

Eastman Television Recording Film, Type 7374, has been modified recently. Both the earlier film and the present modification can be processed very satisfactorily through viscous-layer treatment. The characteristics of this film make it especially suitable for rapid processing. A 15-sec spray wash at 125 F

has resulted in a residual hypo content within limits designated as archival.

Sets of picture-tube exposures on Type 7374 by one of the major networks have been processed to negative gamma values of 0.85 and 1.40, by viscous-layer treatment and through the conventional process. Sets of prints of these films made on Type 7302 for the 0.85 negative gamma, and back onto Type 7374 for the 1.40 negative gamma, have been processed by viscous-layer treatment and by the conventional process. The image characteristics and the physical quality obtained were judged to show no significant differences between the rapid viscous, and the conventional processing.

Conclusion

Rapid viscous-layer processing of Eastman positive films Types 7302, 7373, and 7374 has resulted in physical and photographic quality equal to that from conventional processing. Further work is in progress on the use of rapid viscous treatments for reversal and for negative films.

Viscous-layer treatment appears to have substantial advantages over conventional methods in simplicity of opera-

tion and in the elimination of problems of agitation and chemical control. The viscous process is especially suitable for intermittent service, since little preparation is required after a period of shutdown. The inherent cleanliness of the processed film has been particularly apparent.

Many people in the various divisions of the Eastman Kodak Co. have contributed to the effort to develop this departure from conventional processing methods. Their assistance is gratefully acknowledged.

References

1. F. E. Tuttle and C. H. Green, "Photographic race-timing equipment," *Jour. SMPE*, 27: 529-536, Nov. 1936.
2. C. E. Ives and C. J. Kunz, "Simplification of processing methods," *Jour. SMPTE*, 55: 3-26, July 1950.
3. C. E. Ives, H. D. Russell and J. I. Crabtree, "Fundamental factors in rapid processing," *Jour. Phot. Science*, 2: 7-15, Jan.-Feb. 1954.
4. S. L. Hersh and F. Smith, "Rapid processing: present state of the art," *Phot. Sci. & Engr.*, 5: 48-54, Jan.-Feb. 1961.
5. W. T. Hanson, Jr., and W. I. Kisner, "Improved color films for color motion-picture production," *Jour. SMPTE*, 61: 667-701, Dec. 1953.
6. H. F. Ott and R. C. Lovick, "High-efficiency air squeegee and soundtrack developer applicator for color films," *Jour. SMPTE*, 63: 191-194, Nov. 1954.
7. J. R. Turner, "Photographic processing equipment," *Jour. SMPTE*, 68: 211-221, Apr. 1959. See page 221.

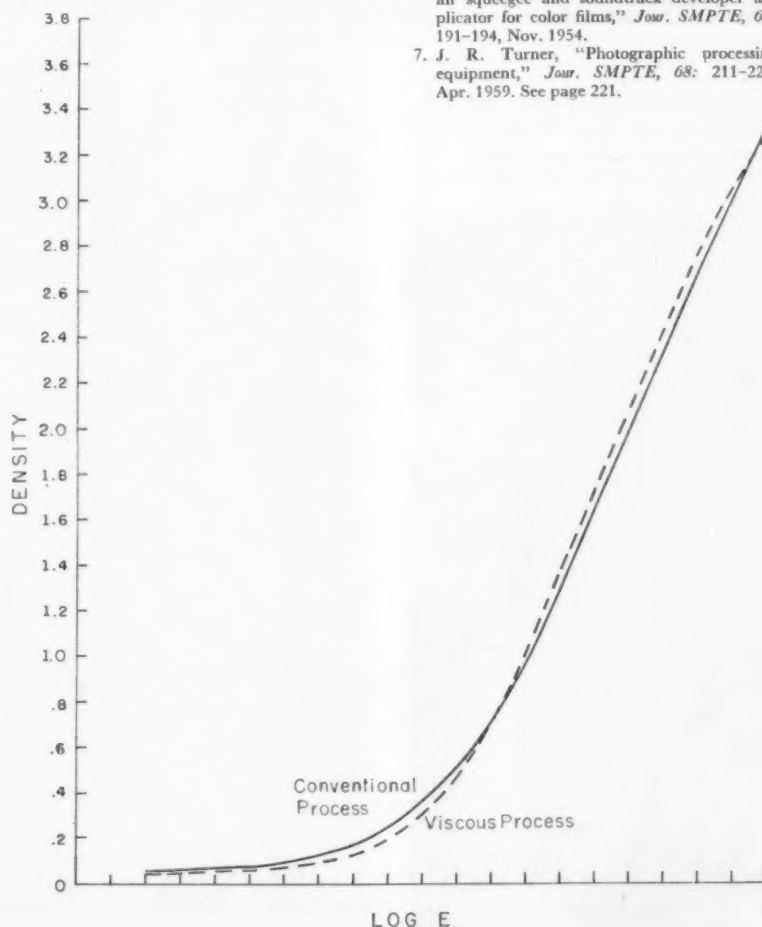


Fig. 3. Comparison of D-log E curves for Type 7302 film through conventional and viscous processes.

Part II: A Machine for Rapid Processing of Black-and-White 16mm Films

By PAUL A. HERMLE and HAROLD D. LOWRY

A rapid simplified processing machine for 16mm black-and-white positive films employs thin coatings of viscous solutions for the developing and fixing treatments at a temperature of 125 F. The film is processed to a precontrolled density and contrast at an operating speed of 36 ft/min, and a dry-to-dry time of one minute. Packaged chemical solutions are used, metered to the film from a five-hour storage capacity within the machine. The only service connections required are electricity, hot water, and drainage.

IN PART I the basic technique of processing motion-picture film by the application of viscous chemical solutions was described. The subject of this paper is the specific application of this technique to the rapid and simplified processing of 16mm black-and-white positive films.

In selecting a processing method for a machine to be designed for both rapid and simplified processing, the viscous technique appeared to be the most ideally suited. It was requested that a machine be developed to meet certain specifications:

(1) Photographic and physical quality equal to trade standards;

Presented on May 11, 1961, at the Society's Convention in Toronto by Paul A. Hermle, Apparatus & Optical Div., Eastman Kodak Co., Rochester 4, N.Y.; and Harold D. Lowry (who read the paper), Color Technology Div., Eastman Kodak Co., Rochester 4, N.Y.
(This paper was received on August 30, 1961.)



Fig. 1. General view of the processor.

- (2) No chemical mixing or control;
- (3) A processing time of about 60 seconds;
- (4) Compactness and minimum service requirements;
- (5) Minimum of skill and care in operation and maintenance; and
- (6) Eastman Fine Grain Release Positive Film, Type 7302, Eastman Fine Grain Sound Recording Film, Type 7373, and Eastman Television Recording Film, Type 7374, are to be processed at 36 ft/min.

Description of the Processor

The machine shown in Fig. 1 processes 16mm black-and-white positive films at 36 ft/min, with a dry-to-dry time of one minute. The developer and fixing solutions are each coated on the emulsion surface as a viscous layer in an atmosphere saturated with water vapor at 125 F. The viscous processing solutions are packaged in one-gallon disposable collapsible polyethylene bags which can be

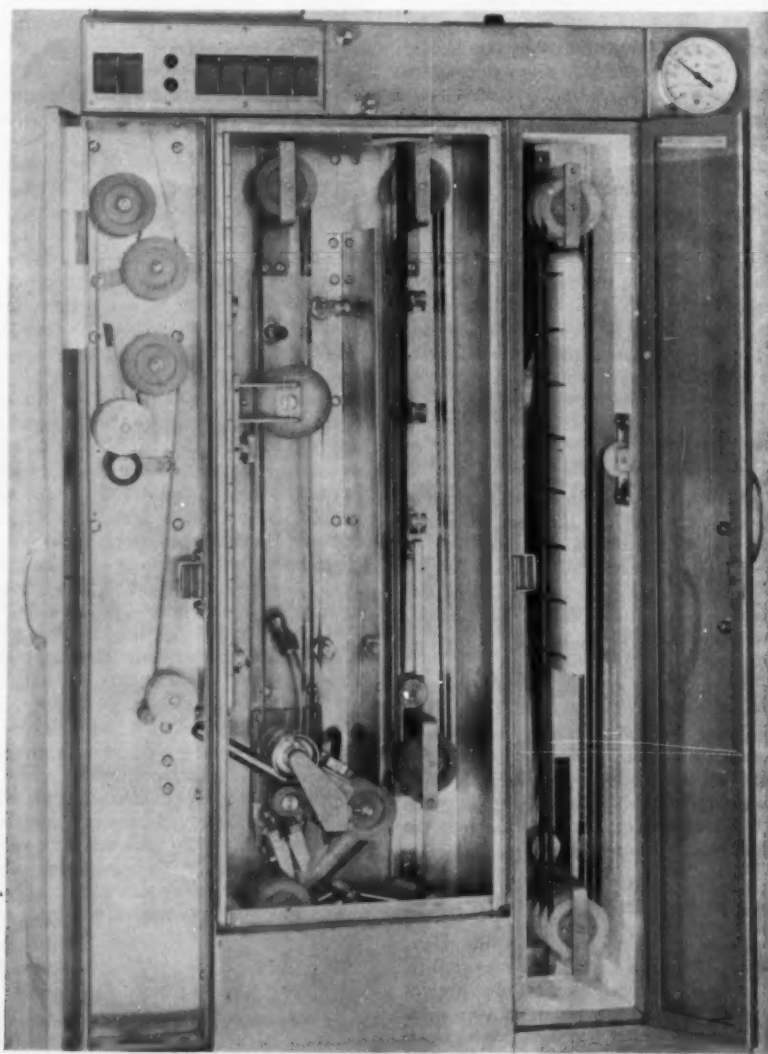


Fig. 2. Chambers of the machine, shown with doors open: left, feed chamber; center, processing and wash chambers; right, dryer.

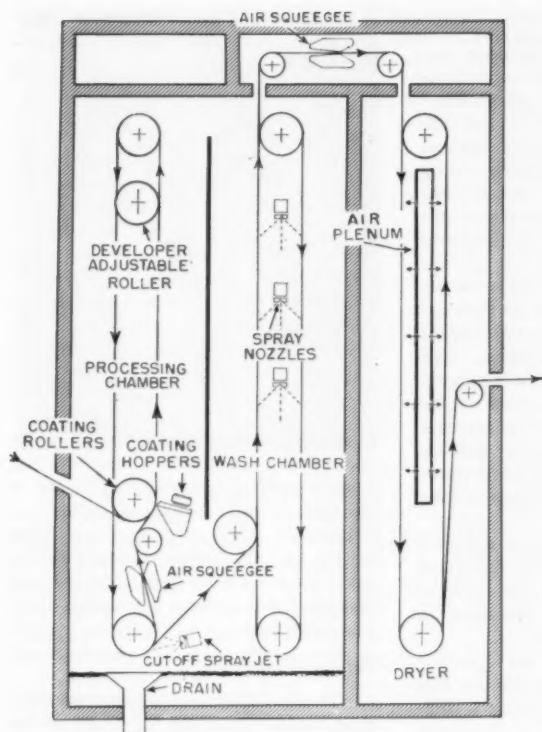


Fig. 3. Schematic diagram of the threadup.

changed without interrupting the processing operation. Enough containers can be stored in the machine for five hours of continuous operation. The processing chambers can be thoroughly cleaned after processing by simply closing a switch to actuate wash-down sprays. A small air compressor is built into the machine for supplying filtered compressed air to two air squeegees. The service connections consist of single-phase electrical power at 115 volts a-c and 20 amp, hot water at one gallon per minute 130 F, and drain.

In Fig. 2 the doors of the various chambers are shown open. On the left is the feed chamber, which contains a small splicing block, an end-of-roll detector, and the rubber-covered pacer roller that paces the film into the machine at 36 ft/min.

The processing and wash chambers are shown as a common compartment in the center with a baffle separating the two. The chamber is insulated to minimize heat loss.

The dryer is shown at the right.

Processing Sequence

Figure 3 is a schematic drawing of the threadup.

The film enters the processing chamber from the feed chamber at the left and passes around the coating roller. At this point viscous developer is applied to the emulsion surface by the coating hopper in a layer approximately 0.008-in. thick. The reaction loop of the developer

is adjustable by raising or lowering the roller at the top to provide developing times of $2\frac{1}{2}$ to 7 sec. By this means a specified contrast may be selected. The developer coating is removed by a high-velocity water spray jet at the bottom roller. The surface water on the film is removed by a Venturi-type air squeegee. The film then passes around a second coating roller where the viscous fix is applied by another coating hopper. Two helical loops are required for the fixing time of 12 sec. The coating of viscous fix is removed by a second spray jet at the bottom of the second loop. The film then passes beneath the partition and into the wash compartment. Three helical loops are formed in the wash stage with the film emulsion toward three spray-nozzles having a hollow, conical spray pattern. The bottom rollers are adjustable to give washing times of 13 to 17 sec. After passing through a second Venturi squeegee, the film goes into the impingement air dryer. The bottom roller assembly for the three loops in the dryer is adjustable to give times of 15 to 21 sec. In summary, the processing sequence includes: viscous developer, spray cutoff, air squeegee, viscous fix, spray cutoff, wash, air squeegee, and dry.

Coating Mechanism

Figure 4 is a close-up of the coating mechanism. One hopper is shown with the cap removed. The assembled hopper can be identified by the knurled screw

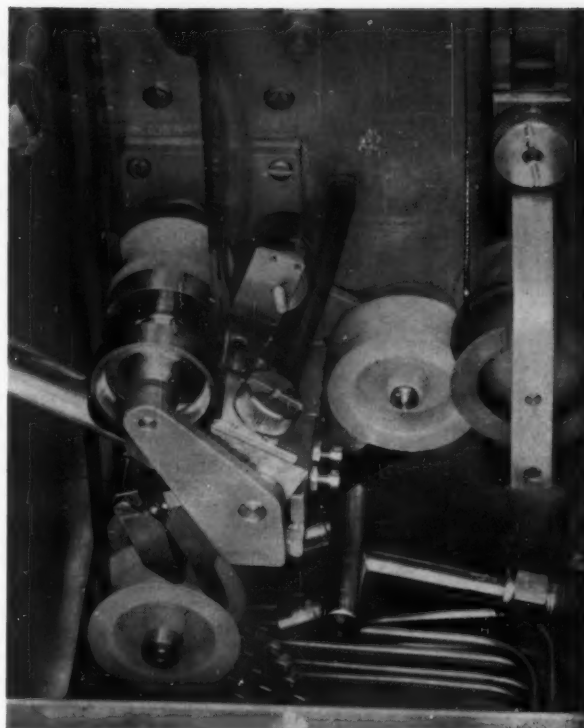


Fig. 4. Close-up view of the coating mechanism with rear hopper shown open.

that holds the cap in place. The hoppers are made of two wedge-shaped stainless-steel elements separated by a U-shaped plastic shim 0.008-in. thick. With the two halves in place, the shim forms a channel as wide as the film and 0.008-in. thick. The solution in flowing through this channel forms a smooth ribbon, which is applied to the emulsion by the method described in the previous paper. Both coating hoppers are hinged to permit the passing of splices.

Solution Supply System

Figure 5 is a view of the rear of the machine showing the solution-storage compartment. The operator is inserting a probe into the cardboard carton that holds the collapsible polyethylene bag of viscous solution. The two bottles at the bottom of the compartment are reservoirs that trap any air that might be brought in during the switching of containers. The bottles also contain enough solution to allow a change of solution containers to be made while processing. In the case of the developer, the solution is pumped through a heat-exchanger coil before passing to the coating hopper.

The coil is located in the sump below the wash and processing chambers and receives heat from the waste water of the wash stage. With this coil, developer at room temperature is brought up to processing temperature before the solution is applied to the film. No coil is necessary in the fix-supply system since the tempera-



Fig. 5. Solution-storage compartment at rear of machine.

ture of the fixing solution is much less critical than that of the developer. Both solutions are pumped using a gear-type positive-displacement metering pump at a rate of 36 milliliters per minute. This is an application rate of one milliliter per foot of film. An alarm timer is installed in the pump circuit, which can be set to warn an operator when the normal running time has elapsed for a container of solution.

Coating Removal

The nozzles used to remove the developer and fix coatings are of the Veejet type (#1/8 U4010)* and are operated at a water pressure of about 20 psi. They provide a high-velocity water jet that covers slightly more than the film width. Water is supplied to the cutoff nozzles by a pump that draws its intake from the sump beneath the wash section. Thus, the wash water is used a second time before being sewered. This conservation of water permits the machine to be operated on a total water input of less than one gallon per minute.

Air Squeegee

The air squeegee between the developer and fix application, shown in Fig. 6, is of the Venturi type, which does an extremely efficient job of removing the surface liquid. This squeegee is essentially a simplified version of a design described by Ott and Lovick.¹ The fix in this process is used to stop development. Hence, uneven distribution of surface liquid would result in unevenness or mottle in the processed film.

* Made by Spraying Systems Co.,

Wash

In the wash section the emulsion surface of the film faces the three, hollow-cone-type spray nozzles (#1/8 B2).^{*} The nozzles discharge 0.28 gal/min each at 20 psi, and serve a dual function in washing the film and in maintaining the saturated atmosphere in the processing chamber. Owing to the downward action of the sprays, air is circulated downward, and in passing through the spray, the air picks up heat and moisture. This heated and humidified air then circulates beneath the partition and upward through the processing section. The cycle is completed by the air again passing into the wash chamber at the top. In this fashion, hot water in excess of 125 F, issuing from the spray-nozzles, establishes and maintains an atmosphere in the processing section approaching saturation at 125 F.

The spray wash is capable of reducing the residual hypo level in the fine-grain positive and TV recording films tested to well within commercial tolerances in the minimum time of 13 sec.

A second Venturi-type air squeegee removes the surface liquid on the film before it enters the dryer. Filtered, compressed air is supplied to the squeegees from a small rotary-vane air compressor within the machine.

Dryer

The dryer is of the impingement type with a slotted plenum that discharges air against the emulsion surface. The development and resulting design of the dryer were aimed at achieving the shortest drying time in keeping with good drying practice, and a dryer with a relatively low noise level. Some impingement-type dryers are objectionably noisy because of the use of high-pressure blowers. In this design, two small, 90-cfm blowers of a relatively low pressure type are used with a recirculated air path. Approximately 10% make-up air is drawn in from the rear of the machine through a filter. The dryer plenum carries a series of slots, $\frac{1}{8}$ -in. wide by 3-in. long, spaced at 2-in. intervals along the drying path. This design was suggested by F. D. Miller. The plenum discharges air at a velocity of about 2,000 ft/min, one-half inch away from the film emulsion surface. The impingement air velocity, while not quite as high as that obtained with a high-pressure blower, is quite effective. In a paper by Miller² it has been pointed out that the drying of rapidly processed film requires a somewhat shorter time than normally processed film because the amount of water absorbed is less as a result of the shorter immersion time in the rapid process. With this dryer, Eastman Fine Grain Release Positive Film, Type 7302 and Eastman Television Recording Film, Type 7374 can be dried in 20 sec at an air

temperature of 110 F. The temperature of the dryer is thermostatically controlled over a range from ambient to 180 F.

In reviewing the preceding steps it should be pointed out that the film has thus far been handled in an exceptionally clean manner. The film has been contained in an essentially dirt-free environment. Fresh processing solutions, free of sludge and scum, have been used once and discarded. Air drawn into the dryer has been filtered. It was therefore apparent that the windup and film lubrication operations be kept equally clean.

Windup

The windup section, shown in Fig. 7, is enclosed with a transparent door. In operation, a small flow of air from the dryer maintains a very slight pressure in the windup area, thereby excluding airborne dirt. After entering the windup section, the film passes vertically downward and takes a 90° twist before passing around the adjustable roller leading to the film lubricator.

Lubricator

The film lubricator is a conventional type, which waxes the full width of the emulsion surface. It consists of a plush-covered roll that dips into a reservoir containing Kodak Movie Film Cleaner (with lubricant). The lubricant level in the reservoir is maintained by the inverted supply bottle much in the same manner as the familiar chicken-feeder. The plush-covered roll is driven at 14 rpm, counter to the direction of film travel.

After lubrication, the film passes vertically upward to the rubber-covered pull-out roller, which is driven by a small torque motor. The rapid processor has 27 film rollers between the pacer and the pull-out. It was therefore possible to have only two driven rolls in the film-transport system.

After passing over the pull-out roller, the film can be wound on either of the two reels. A reel of film can be removed from the machine without interrupting the processing cycle by stopping the spindle onto which the film is being wound. The pull-out roller continues to feed film forming a loop that can be cut; the film can then be attached to the empty reel. A three-position switch (center off) is used for actuating either take-up. The dual-spindle windup eliminates the need for a film storage elevator.

An equipment compartment, which opens to the rear of the machine, houses the bulk of the mechanical components, including the piping for the water and solution supply, the torque motors for the windups and pull-out, and the solution timer.

An electrical panel containing relays, capacitors and open wiring is located in a compartment across the top.



Fig. 6. Air squeegee between developer and fix application.

The machine, which is on casters, weighs approximately 330 lb and requires less than three square feet of floor space. The basic dimensions are 21½-in. long by 16-in. deep by 58-in. high, or approximately the size of a four-drawer filing cabinet. In addition to electricity, the machine requires one gallon per minute of water at 130 F.

During experimental trials it was found that a mixing valve with a pressure equalizer was reasonably accurate for controlling the water temperature. However, in instances where 130 F water is not available and where closer, more repeatable results are desired, a control unit with a booster heater is necessary. A water pressure of 15 to 20 psi at the machine is required for the proper operation of the spray-nozzles.

A switch panel at the front of the machine permits the operation of individual components for warm-up or maintenance. During processing, all the switches would be "on" except the clean-up rinse. If the machine is to remain idle for a long period of time, the processing compartment can be cleaned by depressing the interlocked clean-up rinse switch. This switch energizes a solenoid valve that introduces water to the coating hoppers and also to three wash-down spray nozzles. Clean-up takes approximately two minutes. On a number of occasions film has been processed after an idle period of several days to two weeks with only a five- to ten-minute warm-up.

Conclusion

The machine is essentially an engineering model. A number of refinements are, of course, anticipated. Careful consideration was given to the functional arrangement in the design. Note that access to the various components of the machine is from the front or rear, thus leaving the other two sides free for coupling to a camera or projector. We have operated

successfully coupled to a projector, and intend coupling to a television recording camera at a later date.

The design and development of this machine have been a joint effort among divisions in Kodak Park, the Research Laboratories, and the Apparatus and Optical Division of Eastman Kodak Co. Many months of testing have shown the machine to be capable of rapidly processing positive films to a high standard of quality with a minimum of care and skill.

References

1. H. F. Ott and R. C. Lovick, "High efficiency air squeegee and soundtrack developer applicator for color films," *Jour. SMPTE*, 63: 191-194, Nov. 1954.
2. F. Dana Miller, "Rapid drying of normally processed black-and-white motion-picture film," *Jour. SMPTE*, 60: 85-104, Feb. 1953.

Discussion

L. R. Terry (Canadian Broadcasting Corp.): Have you noticed any image fading after processing when films are stored?

Mr. Turner: No, the keeping characteristics for the film are essentially comparable to other processing.

Mr. Terry: Have you been able to maintain constant density in processing from reel to reel?

Mr. Turner: The repeatability is remarkably good.

Mr. Terry: What tolerances have you been able to maintain?

Mr. Turner: The process variable is essentially

temperature — and the changes in density level are of the order of 0.03 to 0.05 depending upon how close you hold temperature.

George Lewin (Army Pictorial Center): What are the prospects of using this method on 35mm film?

Mr. Turner: We have used the method on 35mm — quite satisfactorily.

Mr. Lewin: What are the prospects of operating at higher speeds?

Mr. Turner: It's capable of operating at speeds of 200 to 300 feet a minute. The model shown was designed for the low rate to permit coupling it to a projector or camera.

Mr. Lewin: Could you compare the cost of the chemicals for this system with the conventional method of developing films?

Mr. Turner: It is to be remembered that chemical costs for conventional methods vary considerably from laboratory to laboratory and also that one must include the costs of chemical losses and storage. The total list price for chemical and fixing solution is indicated as 37 cents per 100 feet. The net cost is less than that.

H. Theodore Harding (Photo Products Dept., E. I. du Pont de Nemours, Wilmington, Del): Would you elaborate on what provisions have been made for this machine to pass splices. I believe the hoppers are hinged so that they roll back.

Mr. Turner: The hoppers are hinged and they will pass splices. I would hesitate to run staple splices.

Mr. Harding: After you have passed a conventional cement splice, about what duration of linear film footage passes before you return to normal development?

Mr. Turner: If it should lift the hopper, you'd find that it would be something less than a quarter of an inch. It would normally clear the hopper without lifting it.

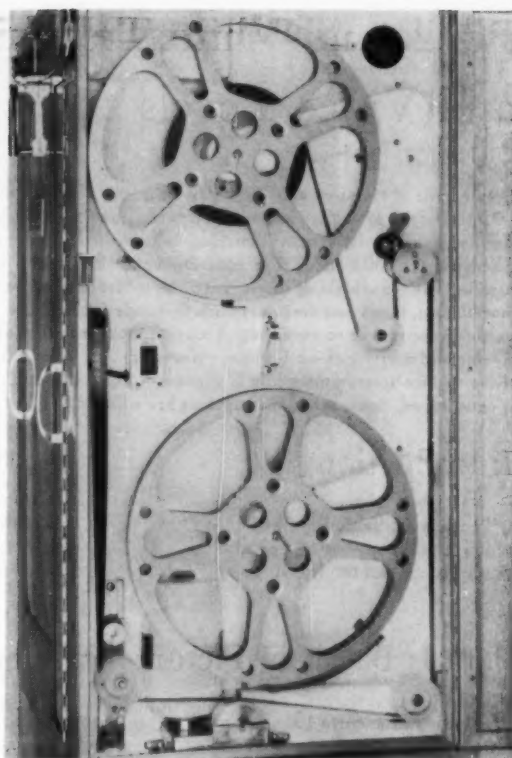


Fig. 7. Windup section of the machine.

Black-and-White Television Monitoring and Video Levels

By HAROLD WRIGHT

Generation of video waveforms by live and telecine cameras is reviewed, together with the basics of picture and waveform monitoring devices. The degree of industry standardization in North America is reviewed. Monitoring procedures are discussed, and the need for accurate control of video peak-to-peak voltages is justified by considering them relative to transmitter and video-tape recorder modulation, film recording, network transmission and the retention of picture esthetics from source to audience. Accurate interpretation of the oscilloscope display is emphasized, black-and-white references are considered and the relation of these to face tones and glints is discussed. The effect of white clipper operation is considered. Some recommendations are offered.

Introduction

There is available very little literature which deals with the operations aspect of television picture transmission levels.

The importance of certain voltage and waveform characteristics in the transmission signal is often misunderstood by both TV live and TV film production groups. If the need for adequate picture transmission signal levels is appreci-

ated, the requirements for high-quality live and telefilm production seem much simpler.

This paper has been prepared in two parts. A brief review of picture signal generation and basic monitoring devices forms Part I. In Part II, the current state of picture monitoring, as practiced in North America, is reviewed and the techniques of monitoring and interpretation of picture waveforms are examined.

Presented on May 12, 1961, at the Society's Convention in Toronto by Harold Wright, Canadian Broadcasting Corp., 354 Jarvis St., Toronto, Ont.

(This paper was received on July 12, 1961, and in final form on September 21, 1961.)

Part I: Basics of Picture Waveform Generation and Video Monitors

Translation of Picture Information Into Voltage Waveforms

In North American TV practice, picture waveforms are generated by a 525-line, 60 interlaced fields-per-second scanning system. In all camera transducers, the patterns of light and shade in the scene imaged by the lens, are converted into equivalent patterns of electrical charges on a target or photoconductor. A scanning beam, following the reading pattern shown in simplified form in Fig. 1, examines this charge pattern and converts it into equivalent electrical voltage values. To extract the maximum of detail information from the scene, the scanning beam cross-section is made as fine as possible, where it coincides with the scanned surface.

Figure 2 shows the simplest possible case of waveform generation, where a card, one-half black and one-half white is examined. The voltage waveform generated for line X-X is shown. This waveform, somewhat idealized, is assumed to be under examination on an oscilloscope with linear horizontal deflection, the deflection progressing from left to right in the same length of time as one picture line scan. It is also assumed that white in the picture generates maximum voltage and black generates minimum voltage.

Figure 3 shows the voltage waveform when a photographic stepwedge is scanned and Fig. 4 shows the waveform for two different lines in a graphic card. Figure 5 shows one line from a monoscope test pattern and has been photographed from the TV control-room monitor oscilloscope. Figure 6 shows the display

from all the lines scanning a scene, superimposed on each other. This is the way the operating technician usually sees it. Current practice leaves some separation or space between black peaks and blanking level and this is called "setup."

In television, blacks and whites in a scene are only considered subjectively in the studio or on a picture monitor. At all other points in the system blacks, grays and whites are voltage levels. The TV camera, unlike the eye, does not concentrate on visual centers of interest and ignore the extremes of light and shade, but will "see," in an electronic sense, both the centers of interest and the extremes of light and shade from the brightest glint to the deepest shadow.

The TV picture is an illusion, produced by TV picture tube phosphor persistence and persistence of vision, because the picture is not there all the time. The illusion that it is there is the result of a flying beam of electrons, spraying the picture tube phosphor like a hosepipe, its intensity dependant on the peak-to-peak value of the picture voltage applied to it. This is quite different from the motion-picture process, where a succession of complete still pictures exists, and may be examined visually.

A detailed examination of the frequency content of waveforms can be found in the literature of Mertz and Gray,^{1,2} Schade³ and others.

Monitoring Devices

(a) The Waveform Monitor

The TV broadcast technician has at his disposal both a picture monitor and

a waveform monitor. The waveform monitor is a specialized oscilloscope with a linear sawtooth time base operating in the horizontal direction. The picture voltages to be examined are applied to the vertical deflection system through a linear amplifier. Figure 7 shows the basic waveform monitor in block functional form. Figure 8 shows the display with the horizontal time base operating but without any picture voltage applied. The horizontal TV synchronizing pulse may be seen in the display. Figure 6 showed the voltage display for a typical picture signal. Waveform monitors as supplied in earlier commercial camera control units were not adequate and Fig. 9 shows a more recent and elaborate waveform monitor used by CBC for critical monitoring locations. Most waveform monitors have a clamp circuit which stops the display from "bouncing" when there is a sharp change in picture content.

Waveform monitors are capable of producing more than one type of display. The most elaborate type is equipped with a device called a "line selector." This incorporates adjustable counting and timing circuits which enable the technician to examine any single selected line out of the 525 making up the total picture frame. Such a selected voltage display was shown in Fig. 5. This type of oscilloscope is generally used only for critical analysis and trouble shooting. The normal waveform monitor displays superimposed traces in two modes, line display or field display.

In the line display mode all the lines of one field are superimposed on each

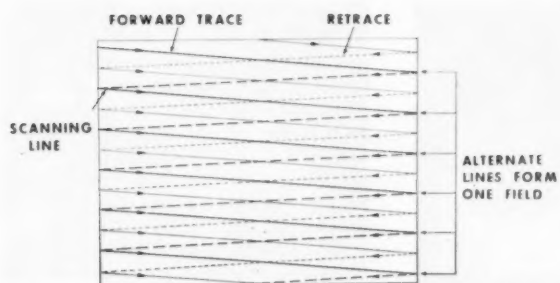


Fig. 1. Simple presentation of North American interlaced scanning system.

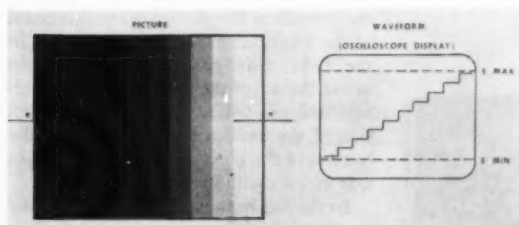


Fig. 3. Voltage waveform generated by scanning one line through a ten-step gray scale or step wedge.

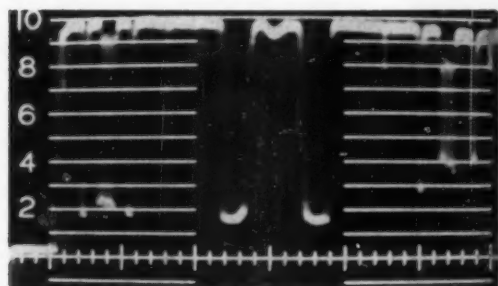


Fig. 5. One selected line waveform from a monoscope Indian Head test pattern.

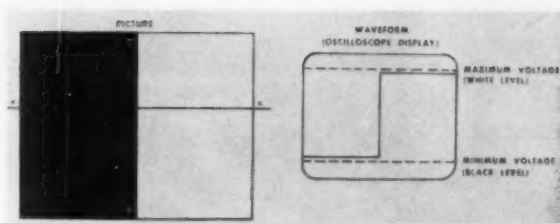


Fig. 2. Voltage waveform generated by scanning one line from a half-black, half-white card.

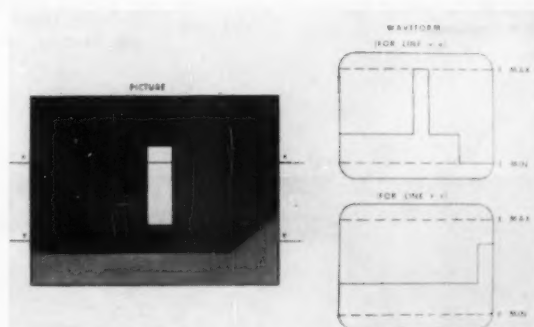


Fig. 4. Voltage waveform generated for two separate lines in a graphic card.

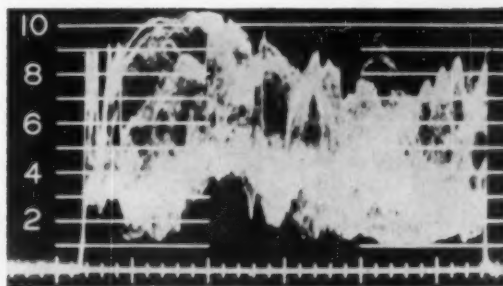


Fig. 6. Oscilloscope display showing all the line waveforms for one scene, superimposed on each other.

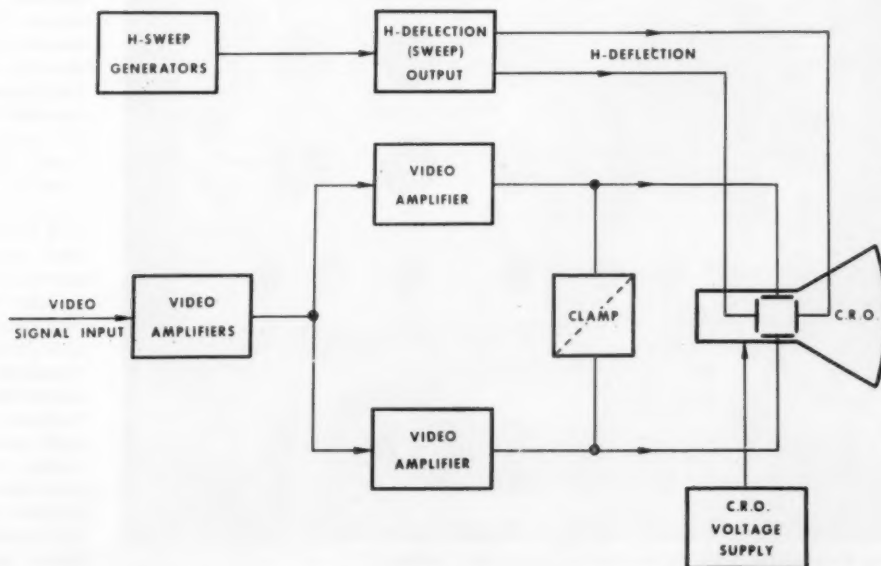


Fig. 7. Basic block functional of a television waveform monitor.

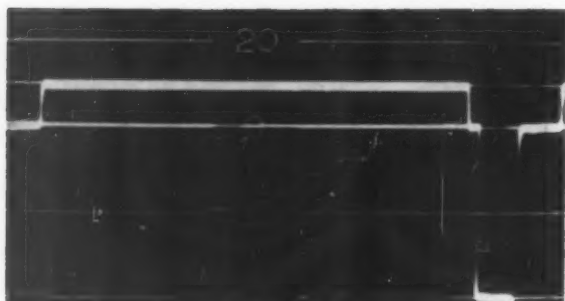


Fig. 8. Waveform monitor display before any picture voltages are applied.

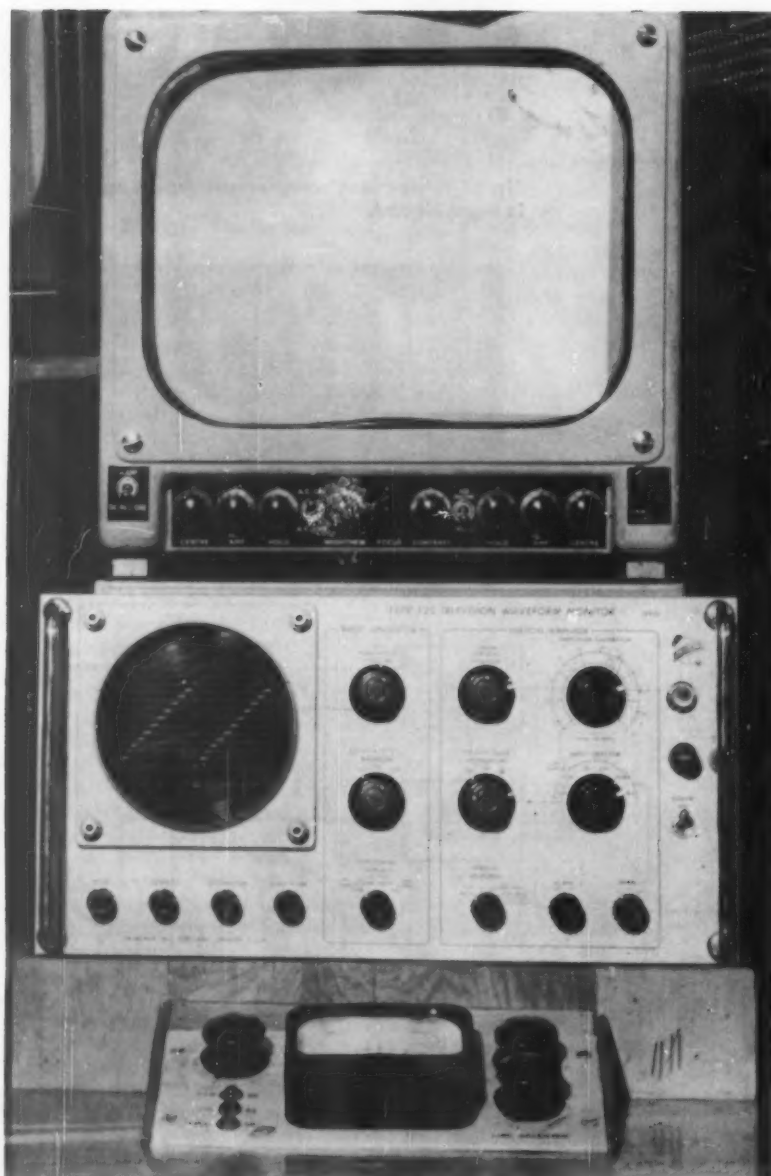


Fig. 9. Critical monitoring position, as used in CBC studios.

other; phosphor persistence and persistence of vision combine to give a voltage display simultaneously from the entire picture area. Figure 6 showed a typical superimposed line display. The oscilloscope time-base is usually 7,875 cps (cycles per second) which provides two sets of picture waveform displays and one display from the horizontal synchronizing pulses.

In the field display mode the oscilloscope time-base rate is changed to coincide with the television field rate of 60 cps or a submultiple of it. A 30-cps rate is most commonly used. This changes the geometry of the relative picture and waveform displays. For line displays the left side of the picture content appears at the left side of the oscilloscope, but in the field display all picture elements across the top of the picture appear simultaneously as voltage displays at the left side of the oscilloscope and those at the bottom of the picture appear at the right side of the oscilloscope.

In the field-rate waveform display, the oscilloscope takes one-thirtieth of a second to sweep from left to right while, during the same period the picture field scan is developing from picture top to picture bottom and returning to the top to repeat the process for the next field. Thus, with a 30-cps oscilloscope time-base, two fields, together with the vertical synchronizing signal, are seen on the waveform monitor. Figure 10 shows a television picture and Fig. 11 shows the line display waveform for it. Figure 12 shows the field display for the same picture. Thus, every time a scene is monitored on field display a mental re-orientation of 90° is required when interpreting the information.

(b) The Picture Monitor

The picture monitor consists of a picture tube and its associated deflection circuits, video amplifier and power supply. Video voltages modulate the intensity of the tube's scanning beam, thereby creating a pattern of varying luminances on the tube face. This provides the halftones which make up the picture. Figure 13 is a simplified block diagram of a typical picture monitor. In addition to the usual picture controls which determine size and linearity, the monitor has a contrast and brightness control. The contrast control in effect is a gain control in the monitor video amplifier and the brightness control determines beam intensity and therefore the average luminance produced on the screen. It is unfortunate that these controls are required in current picture monitor design because their presence has led to considerable misuse and misunderstanding. However, current designs are subject to considerable drift which means we will have the controls for a while yet. The subjective appearance of the picture can be



Fig. 10. A television picture.

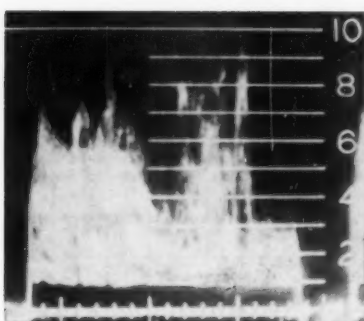


Fig. 11. The line-rate, superimposed waveform display for the picture in Fig. 10.

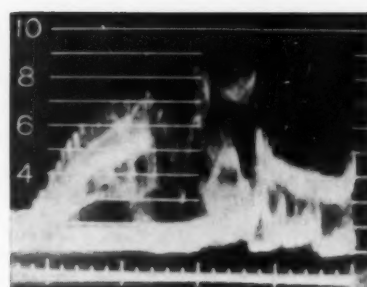


Fig. 12. The field-rate, superimposed waveform display for the picture in Fig. 10.

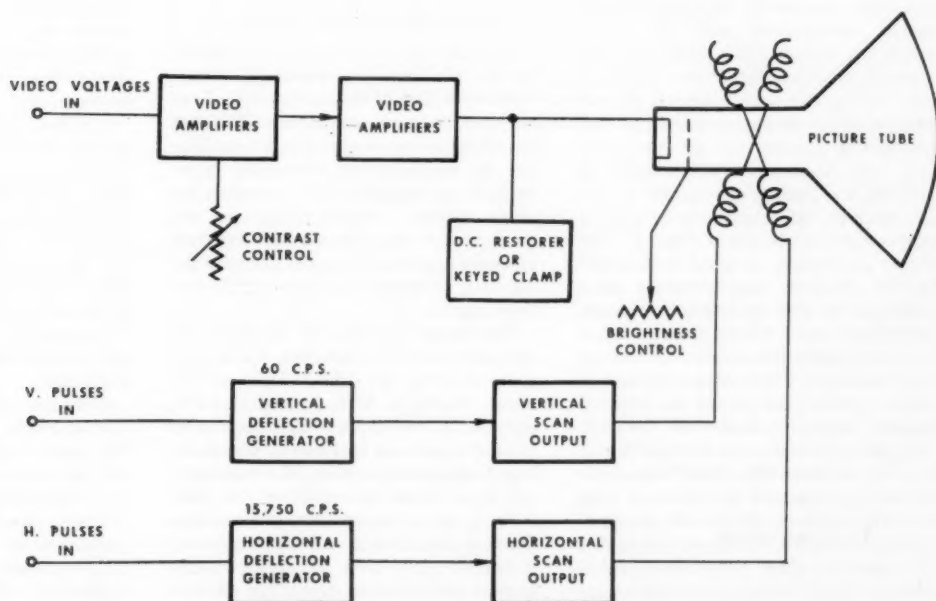


Fig. 13. Basic block functional of television picture monitor.

changed to a remarkable degree by adjustment of the contrast and brightness controls. The nearest motion-picture equivalent would be a review room in which the room lighting control is on a powerstat and the projectionist could set it wherever he chose.

Transfer Characteristics

Picture waveform origination is in the camera tube. In most cases in North America, this will be either an image-orthicon tube or a vidicon tube. A study of video levels and waveform interpretation is helped if the initial light-to-picture voltage transfers are understood. Considerable confusion has existed because of a lack of uniformity in methods of plotting, combined with misuse of the photographic term "gamma." Wentworth⁴ has offered excellent ground rules for plotting that, if followed, would help to simplify the literature of the future.

Initial transfer characteristics, in CBC

operations are indicated by the crossed linear staircase display shown in Fig. 14. This display is derived from an image-orthicon camera with optimized alignment, and then exposed to the EIA logarithmic reflectance chart. Camera tubes are operated sufficiently over the knee to linearize the waveform display from the chart. Thus, the initial transfer, in the studio, gives linear voltage increments for log scene luminance increments. Experimental work is being conducted to arrive at faster, simpler methods of arriving at optimum camera adjustment.

In film reproduction, where film chains are entirely multiplexed commercial vidicon equipment, a staircase slide is used to arrive at optimum adjustment of the chain's transfer characteristic, which includes the optical portion of the chain. The development of this slide and the telecine waveform displays from it have been explained in detail in an earlier paper by Murch⁵ and its manufacture by

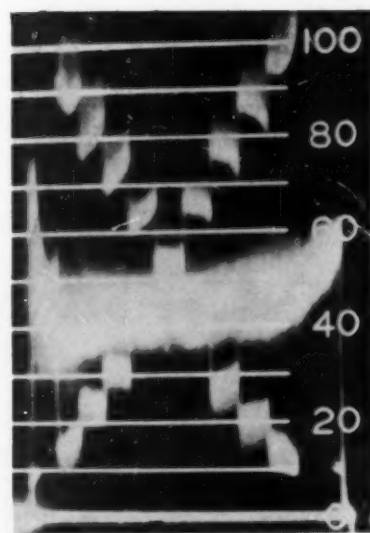


Fig. 14. Line rate waveform display from image orthicon camera and E.I.A. logarithmic gray-scale chart.

Holmes.⁶ Operational practices are outlined in CBC Engineering Standards.⁷

Uniformity in camera matching and adjustment is really the first step towards uniformity in video levels evaluation.

References

1. Pierre Mertz and Frank Gray, "Theory of scanning," *Bell System Tech. J.*, 13: 464, July 1934.

2. Pierre Mertz, "Television — the scanning process," *Proc. IRE*, 29: 529, Oct. 1941.
3. Otto H. Schade, "Image gradation, graininess and sharpness in television and motion-picture systems — Part I: Image structure and transfer characteristics," *Jour. SMPTE*, 56: 137-177, Feb. 1951.
4. John W. Wentworth, *Color Television Engineering*, Part II, Chap. 6, McGraw-Hill Book Co., New York, 1955.
5. L. J. Murch, "An engineering approach to

television film — Part I: Standardized gray scale characteristic for vidicon telecine," *Jour. SMPTE*, 68: 740-743, Nov. 1959.

6. Leslie H. Holmes, "A method of producing telecine test materials of specified density," *Jour. SMPTE* 70: 699-701, Sept. 1961.
7. CBC Engineering Standard Ref 4.2.5-3, "Vidicon Telecine Set-up Procedure"; and CBC Engineering Standard Ref 5.2.5-3, "Calibrated Television Staircase Test Slide and Window Test Slide."

Part II: Black-and-White TV Monitoring and Video Levels

Introduction

The scanning of a television picture gives rise to video voltages having random waveshapes and fluctuating voltage amplitudes. These video voltages or waveforms carry the picture information, both picture-tone scale and picture detail, throughout the remainder of the transmission process and are converted back into luminance values only at specified monitoring points and at the TV receiver. The locations of critical monitoring are shown in Fig. 1. The proper generation, control and maintenance of these voltages is of great significance if high quality transmissions and recordings are to be obtained. It has been adequately proved that the success of all forms of TV recording is dependent on the peak-to-peak values and internal dynamic voltage distribution between these peaks, of the video voltages which drive the recorder. The current emphasis on the increased use of tape and film, with large segments of network programming originating from these sources, makes it imperative that video transmission voltages be maintained at their optimum at all times. This in turn lays equal emphasis on the accurate interpretation of video waveforms by operations personnel. An examination of the subject also shows a remarkable absence of standardi-

zation in North America, in both the monitoring devices, picture and waveform, and the methods of use.

The Current State of the Industry

Although some progress has been made by the television broadcasting industry in the direction of standardization, there are many gaps remaining. Written standards are never an end in themselves, but the constant and increasing international exchange of TV programs by direct network service, video-tape recordings, television film recordings and motion-picture films, makes the need for common standards in monitoring devices very urgent.

On waveform monitors the design of the scale has been specified for several years now by the IRE.¹ This scale is shown in Fig. 2. It is divided into 140 equal units, 100 of the units representing picture signals and the other 40 representing synchronizing signals. EIA standards specify a total excursion of 1.0 volt from tip of sync to peak white for monochrome signals and specify minimum standards for the amplitude-vs.-frequency and phase-vs.-frequency characteristics of the vertical deflection amplifier. Picture white peaks occur at 100 units on the IRE scale.

In black-and-white transmission, setup or black level has been specified in EIA

standard RS-170 as $7.5\% \pm 2.5\%$ minimum. Maximum setup is not specified in this standard, but FCC (in the United States) Rule 3.682 (a) (17) specifies minimum setup as 5% and maximum as 10%. There are considerable variations in operating practices throughout North America.

Current CBC network practice leaves 10 IRE scale units between the voltage level for picture blacks and the blanking level. The CBC network standard is 7.5% of picture amplitude $\pm 2.5\%$, but most CBC originating studios operate at the upper end of the tolerance. Thus, the total picture signal excursion is only a peak-to-peak voltage of 0.64 volts. It is however much more convenient to refer to picture voltages in terms of IRE scale units.

Desirable frequency response roll-off characteristics have been specified by the IRE since 1950. Revisions of this standard¹ in 1958 increased the attenuation of high frequencies somewhat, the primary purpose being adequate suppression of the color subcarrier in color TV transmission. The change is not significant when monitoring monochrome picture signals. While new equipment is built to meet the new standard, there is equipment in use in North America with both the original and the revised IRE roll-off characteristic. Many

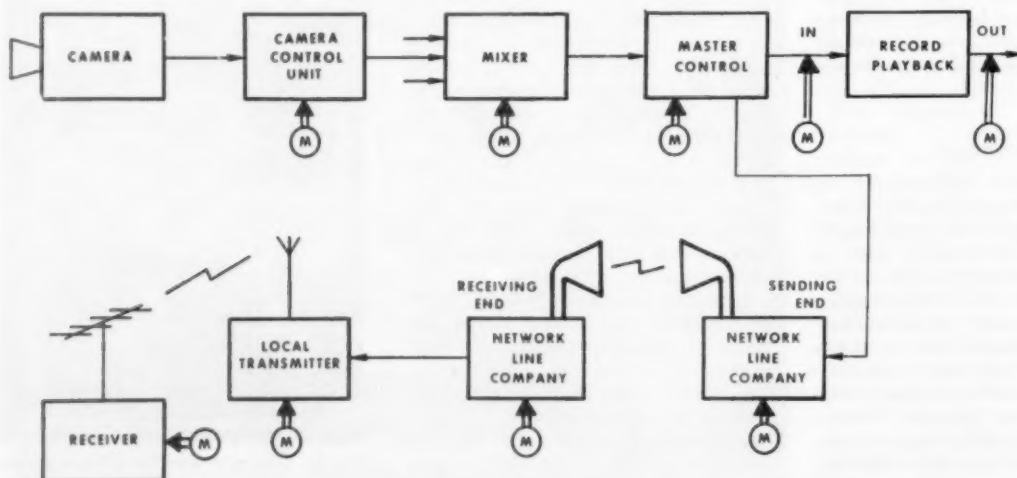


Fig. 1. Block functional showing locations of critical monitoring.

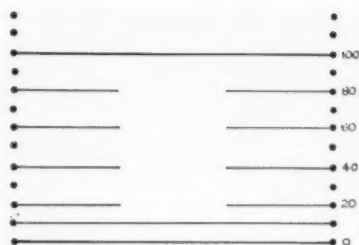


Fig. 2. The standard IRE waveform monitor scale.

waveform monitors are equipped with a switch in the amplifier which provides either "flat" frequency response or the IRE roll-off characteristic. The graphical characteristics for the IRE roll-off are shown in Fig. 3. Figure 4 shows a group of test sine-wave bursts at various frequencies as seen on an oscilloscope set to "flat" and to IRE roll-off.

For the voltage display on a monitoring oscilloscope to be meaningful it is essential that the vertical deflection be accurately calibrated. This is particularly so when the same program transmission is being monitored simultaneously by the studio, master control and various network repeater points. The same problem has existed in radio networks for many years and the combination of the standard VU meter with a calibrating tone at specified level has solved the problem. Unfortunately, television has not yet reached the stage where all monitor oscilloscopes conform to the same specifications; in other words, there is no standard waveform monitor nor is there any recommended practice for calibration and reading. But by using the standard IRE scale referred to, avoiding parallax error between the scale and tube face, keeping the oscilloscope beam as finely focused as possible and using a voltage pulse accurately calibrated to some other secondary standard, a fairly high degree of uniformity is possible. An internal standard² has been developed in CBC Engineering, whereby the Tektronix 525 Waveform monitor and Tektronix 524 oscilloscope may be d-c calibrated to an accuracy of $\pm 1\%$ by reference to a Weston 901 d-c voltmeter. With a master oscilloscope calibrated in this manner, other oscilloscopes in the station may be referred to it.

Probably the greatest lack of standardization and uniformity is found in the picture monitor situation. The EIA³ has specified monitor characteristics having to do with picture fidelity, but mainly from the standpoint of geometric distortion, amplifier response and resolving power. Luminance is specified as being at least 15 ft-L without appreciable blooming and capable of providing a brightness ratio of at least 30:1 over large areas. Nothing is said about the total overall transfer characteristic or

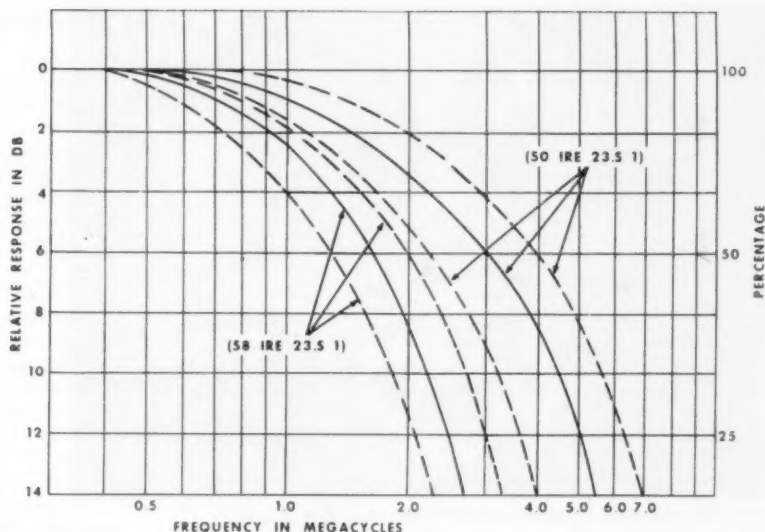


Fig. 3. The IRE waveform monitor oscilloscope frequency response shown graphically.

how the monitor should be adjusted for critical monitoring and there are wide variations in monitors and methods of adjustment.

A further problem occurs in control rooms fitted with a number of monitors. Some picture tube phosphors exhibit a brownish cast in the picture and others a bluish cast. There is no standard for picture monitor tube phosphor emission color. This creates a problem for the technician attempting to match several cameras when he is forced to use non-uniform phosphor emission colors in his picture monitor tubes.

Some quite expensive commercial picture monitors have been examined and showed severe interactions between their various controls. One monitor suffered changes in the differential gain (gray scale or amplitude response) characteristics each time the setting of the contrast control was changed. Another combined picture and waveform monitor was discovered to have voltage interactions through its power supply so

that a change in brightness setting, or even picture content on the picture monitor, would disturb the calibration of the oscilloscope.

In a recent survey covering a large number of network studios and including measurements on 295 picture monitors, the contrast ranges normally arrived at by the operating crews were measured. They ranged from a low of 6:1 to a high of 260:1. Peak white luminance settings varied widely but it was noticed that the more experienced technicians tended to set the peak white luminance at a mean of about 16 ft-L. This seems significant in view of its close coincidence with screen luminances currently used for many motion-picture review rooms. With variations in monitor adjustment as great as those indicated above, it is amazing that TV production groups manage to control picture output at all. Monitor stability was also examined by the CBC Transmission and Development Department, from the viewpoint of variations in contrast range and peak

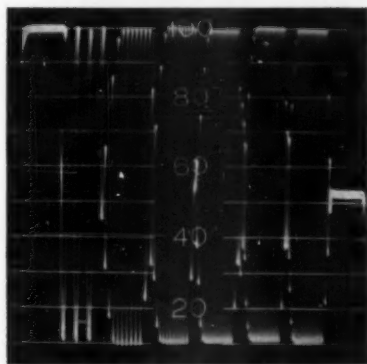


Fig. 4(a). Output waveform from a "burst" generator. Reference white pulse at left. Bursts are sine wave at frequencies of 0.5, 1.5, 2, 2.8, 3.6, 4.2 mc.

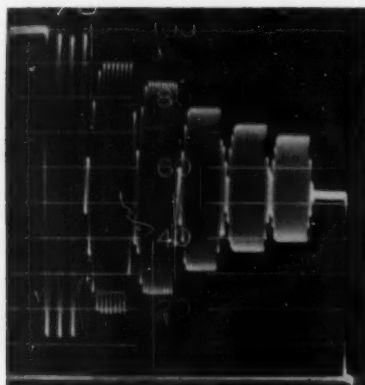


Fig. 4(b). Waveform of Fig. 4(a) as it appears on an oscilloscope set to the IRE roll-off.



Fig. 5. Enlargement from a frame of TV film recording negative.

luminance. It was found, on some monitors, that line voltage variations of only 1% were sufficient to shift the contrast range by as much as 11%. From this it was concluded that voltage regulation for the a-c supply was desirable.

When attempts were made to set peak white monitor luminance to a specified value and arrive at a repeatable setting, the brightness controls on the monitors examined were found to be so coarse that adjustment was very critical and difficult, leading to the conclusion that finer control of the brightness setting would be desirable. Such a vernier control, apart from making the adjustment easier would have the psychological effect of inducing technicians to set it more accurately.

Monitors with simple d-c restorers were found to be incapable of maintaining a stable "black" luminance with certain types of picture content. Monitors with clamps showed little variation.

The effect of ambient light on a picture screen is well known. Its level has never been specified for TV control rooms (as it has been for motion-picture review rooms), is frequently very high and it may be turned on and off in a random manner. One TV station control room visited by the author had a full fluorescent ceiling on all the time. It is not hard to realize, then, that groups attempting to evaluate motion-picture film for TV are baffled by the differences in its appearance in different control rooms. There is almost no standardization in this area. In addition to the effect of high ambient light on the picture display, it can lead to serious errors in the reading of waveform monitor oscilloscopes, most of which operate without a hood or light shade.

The Importance of Video Levels and Peak Voltages

There is need for a thorough understanding of the subjective aspects of

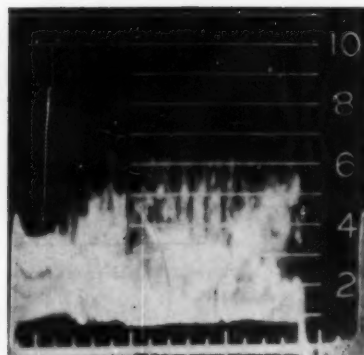


Fig. 6. Video levels for the picture of Fig. 5 set so that highest glint spike just reaches 75 IRE scale units.

monitoring and their relationship to the objective displays provided by the oscilloscope. Both TV live and TV film production groups are often unimpressed and sometimes bewildered by the television engineer's emphasis on video voltage values. There are sound reasons for this emphasis.

(1) *Regardless of source, video voltages are used to modulate the picture transmitter.* Failure to maintain proper peak-to-peak video voltages will result in lowered picture modulation peaks in the transmitter output. This, in turn, will reduce the signal-to-noise ratio of the received picture. It is well known that noise in a TV picture draws visual attention to the nature of the two-dimensional screen and tends to reduce the three-dimensional illusion created by good design, lighting and shooting practice. Low video voltages will also reduce the contrast range of the received picture and cause it to appear poor by comparison with pictures received from another station which is fully modulating its transmitter. Sharp variations in video levels from program to program will also make it necessary for the discriminating viewer to leave his chair and make an adjustment to the contrast control. If this happens frequently it becomes a source of annoyance.



Fig. 7. Same picture as Fig. 5, but gain has been increased and most major spikes clipped.

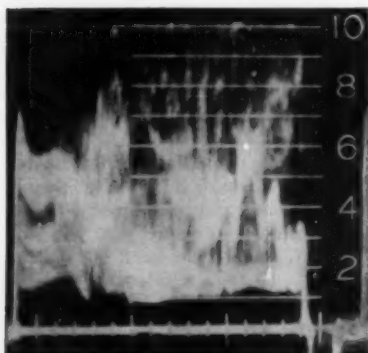


Fig. 8. Waveform condition for Fig. 7.

While full video voltages are required to properly modulate the transmitter, excessive voltages cannot be tolerated. Voltages which exceed the proper value for peak white in the picture cannot be allowed to reach the modulator or they will cause over-modulation, producing the familiar and annoying intercarrier "buzz" in the accompanying sound. Voltages representing picture blacks cannot be allowed to exceed the correct level or they may cause interference with the television synchronizing signal. Thus the peak-to-peak values of the signal must be held to tight tolerances, and to make certain they are not exceeded, special clipping circuits are used at the transmitter which remove all peaks exceeding specified values.

(2) *Video voltages from all sources are used to modulate the FM carrier in a video-tape recorder.* If excessive white peaks are permitted to reach the video-tape recorder (VTR), a particularly unpleasant form of picture tearing may occur. The lefthand edge of a highlight produces a black picture tear running to the right. Low video levels to the VTR will, of course, do nothing to improve the signal-to-noise ratio.

(3) *Video voltages from all sources are used to modulate the picture-tube beam in a television film recorder.* Variations in black level or peak white level will cause serious deviations in negative and print density when TV film recordings are made. This has been described in a previous paper.⁴ Low video levels will be particularly damaging to a TV film recording, because they will seriously reduce the print contrast range. This can be offset only by increasing telecine playback gain, thereby producing a very poor signal-to-noise ratio, and a degraded picture tone scale.

(4) *Most video signals will be carried through many amplifiers; this is particularly so in the process of network transmission.* If the signal amplitudes are lower than they should be, gain will have to be increased with the possibility of reductions in signal-to-noise ratios. Conversely, if video voltages fed into amplifying systems are excessively high, amplifiers may be overloaded, nonlinear portions of the amplifier's transfer characteristic may come into operation, the tone-scale of the picture will be distorted, and other picture degradations may be introduced.

(5) *The maintenance of proper peak-to-peak voltages is one of the best forms of insurance from the producer's viewpoint.* When levels are maintained, those portions of the producer's ideas which are visual from a luminance level viewpoint are preserved in the normal process of transmission. When the peaks are not maintained, low key may be converted into high key, night scenes may become day scenes and increased noise may add further to the ruination of the producer's esthetics.

Black and White References

In the preceding paragraphs, considerable evidence has been presented which shows the need for maintaining full peak-to-peak voltages. The best way to accomplish this on a consistent basis is by the introduction of the so-called white references and black references in the scene so that peak voltages in the white and black direction are produced.

The producers of syndicated package films for television learned the value of black and white references at a very early stage. While it may not have been based on waveform analysis, the approach was sound. These groups found it necessary to "protect the faces with whites." In other words, they found that the absence of white references brighter than faces tended to create a situation during the broadcast where the faces were too white, lacking in detail and, much worse, lacking almost entirely in the three-dimensional characteristics produced by good makeup, lighting and shooting techniques. These groups, by a process of selection, or perhaps elimination, had discovered something which is still far from being universally known or practiced by stations and networks even during live transmission. The reason for this may be that the film producer's program is completed long before its actual broadcast and the producer will have a sufficient "cooling off" interval to enable him to sit at home and watch the production with a fair degree of objectivity.

The producer of the live program, in the heat of the moment and the hectic atmosphere of the studio control room, is much less likely to be objective and may never see the actual transmission on a receiver. Perhaps the increasing use of pre-taped TV programming may improve this situation.

The engineer's insistence on black and white peaks, in live transmissions, while partially sparked by his knowledge of the need for adequate transmitter modulation and good recordings, also stems from his knowledge that this is the best protection for all the work that has gone into staging, lighting and shooting. The producer and his stage and technical crew have worked very hard to create a good story mood or make a songstress look as beautiful as possible. Yet absence of proper picture level references can easily nullify much of this effort and the engineer knows this. Even so, his motives are often misunderstood.

There is much disagreement and confusion as to what constitutes a good peak white voltage and the expression "glint" seems to be open to many interpretations and definitions. The *Merriam-Webster Dictionary* defines a glint as "a gleam; a flash; also, brightness; lustre." Some definitions lean more toward a transient. Transient, short duration peaks

with a dominance of high-frequency content can occur. A good example is the intermittent specular reflection from an earring which bobs around as the performer's head is moved. But its pulse-width is determined by the camera shot size and in a close-up could be quite a large spike.

On the other hand, glints as defined by Webster could easily occur from cut-glass objects, motionless on a table, or from polished sections of musical instruments. These will produce high-amplitude spikes which might better be called "nonessential peaks." This type of spike will not be noticeably reduced by the IRE roll-off characteristic. Theoretically they should be controlled by good studio practice, but in practical operations they often cannot be. For example, no musician will permit his musical instrument to be sprayed with an anti-gloss compound. This type of peak is not transient in nature and may be quite high compared with essential gray-tone voltages. One network engineer in the United States has suggested that the IRE roll-off characteristic should be much more drastic than it is by present standards.

A further bad effect of using glints as white peaks is the crowding of more important tone values in centers of interest into the middle and lower range of the voltage scale. This will result in a restricted gray scale, possible black compression or loss of shadow detail and in many cases an apparently lower resolution due to the psychological effect of reduced contrast on apparent resolution.

The only remaining solution to the problem of glints, spikes and nonessential peaks in the white direction is the application of a peak white clipper. Many commercial white clippers suffer from white compression and other forms of distortion. They tend to compress the whites long before actual clipping occurs. Some commercial types will also be found to have sufficient residual series capacity to pass short-duration transient spikes. Some networks in North America have built their own white clipper units to avoid these distortions.

Figure 5 is an enlargement from a frame of 16mm TV film recording. The scene chosen is one which would produce a considerable number of nonessential peaks in the form of highlights from the tableware. Figure 6 is the line-rate waveform for the picture in Fig. 5. Maximum peaks are reaching only about 75 IRE scale units and this would be classified as low level. Note that the associated picture is quite dark. Figures 7 and 8 show the picture and waveform with the levels corrected and the tips of most nonessential peaks clipped off. This could be considered as "normal" picture level. Figures 9 and 10 show the picture and waveform when white clipping is excessive. The picture is beginning to



Fig. 9. Same picture as Fig. 5, but with excessive white clipping.

lose highlight detail. Figures 11 and 12 show the effect of misadjusted black-level, and Figs. 13 and 14 show the same model in a setting where there are no glints from objects such as glassware. The differences in picture appearance are even more noticeable when viewed on the television system.*

Another, and often ignored, class of unwanted spikes consists of those generated in the camera tube or camera, due to faulty camera tubes or camera misadjustments, and those produced by ringing at the end of blanking. Such spikes may have amplitudes much in excess of normal peak white. When they are held at peak white by adjustments to

*In the presentation at the Convention, these effects were demonstrated by projecting a portion of TV film recording print. This is a much more effective display than is possible in the illustrations for this paper.

the gain control, essential gray tone voltages are compressed into the lower portions of the scale causing serious picture degradation.

Noise and other spurious signals, originating in the camera and amplifiers preceding the monitor point, may also add confusion to level setting. This can be particularly troublesome when the oscilloscope display "fuzz" from the noise appears at the white end of the scale. The British Broadcasting Corporation's approach to this problem is the application of a phaseless cutoff filter at camera output. Cutoff coincides with the transmitted bandwidth and camera noise does not appear in the transmission signal or on the monitoring oscilloscope.

The motion-picture producer has had a considerable advantage in regard to peaks because the nature and shape of film transfer characteristics are such that white spike or glint information is

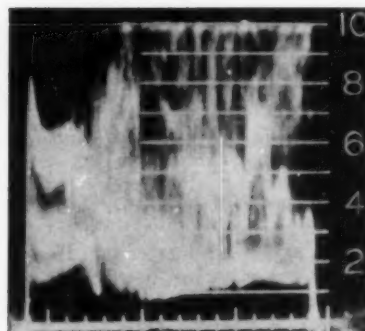


Fig. 10. Waveform condition for Fig. 9.

reduced in several ways. First of all, the curved toe portion of the print-through or overall film characteristic acts as a compressor and the base-plus-fog density of the film material acts as a final clipper. The reduction in resolution of contact printers produces the equivalent of a high-frequency roll-off characteristic. Anyone who has monitored a large amount of telefilm on a picture and waveform monitor will have noticed the absence of high-frequency spikes, or "grass" of the type commonly seen in the output of live studios, and the tendency for the picture waveform, when the film has correct TV densities, to "fill the waveform graticule." Figure 15 shows a good telefilm production waveform. By comparison, Fig. 16 shows a waveform from a live studio scene. The absence of high-level glint spikes in the transmission signal from a telefilm gives it a sharp advantage over the live production. As indicated previously, the introduction of a distortion-free white clipper into the live camera output will go a long way toward balancing the difference between the two sources of transmission signals.

But how are we to decide on adequate white peaks and then how are we to achieve them? A light colored shirt collar might produce only a fine spike in the waveform on a wide establishing shot; yet the same collar may produce a good portion of waveform at 100 IRE scale units when the same person is taken in



Fig. 11. Picture resulting from levels misadjustments. Spike peaks at 100 IRE scale units, no white clipping. Black level misadjusted (ten units too high).

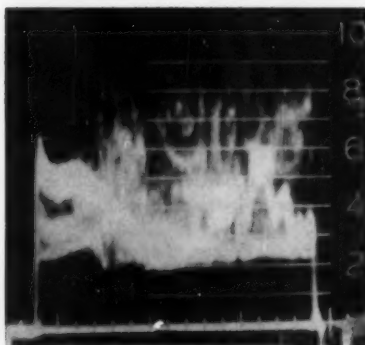


Fig. 12. Waveform for Fig. 11.



Fig. 13. Same model as in Fig. 5 and 11 but in a scene where there are no glints.

close-up. There are many ways to provide the necessary peaks through lighting, properties or costumes, without spoiling the producer's desires in terms of key or mood. Costumes provide one of the easiest means of producing useful peaks in the waveform. Light-colored picture frames or lighted portions of windows represent another easy means.

One solution to the problem of network picture levels would be to key in either an unmodulated staircase or a white bar signal on one or more lines of the vertical back porch. Methods of doing this have been described in a paper by Popkin-Clurman and Davidoff.⁵ This reference pulse would have to be introduced at the program originating point and could then be referred to by network repeater points and station master controls. It would not relieve the originating studio of responsibility for maintaining proper video levels, but it would take the guesswork out of level setting at the receiving end of the network. The Columbia Broadcasting System is currently working on a reference pulse system as an aid to controlling picture levels. Video-tape recording would introduce difficulties because such

references would be obliterated by the playback processing amplifier. It is not beyond the realm of possibility that such a reference pulse could be used to operate a keyed automatic-gain-control device and thereby overcome the problem of network fades.

Black peaks and black level do not seem to have many of the problems which beset white levels. For one thing, there is no black equivalent of white "glints." Black references, which are the shadows in a scene, are usually large enough to avoid misinterpretation and any black spikes which might exceed them are clipped off by the black level setting circuit, which incorporates a clipping action. It is common practice, in both live studio operations and telecine operation, to make further good use of this action, by deliberately setting the black level slightly below normal, thereby clipping some black peaks where they reach setup. This process, sometimes called "black level cheating", may assist in achieving a clean, noise-free black background in special-effects shooting.

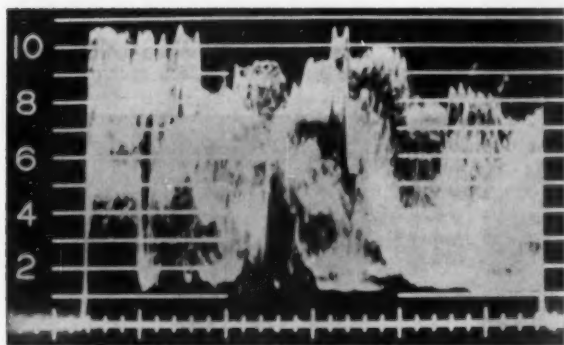


Fig. 15. Line rate waveform for a typical telefilm scene, as reproduced on a vidicon telecine.

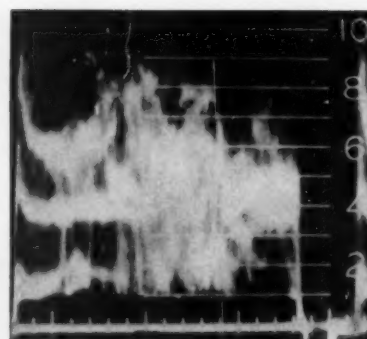


Fig. 14. Waveform for Fig. 13.

There has been a tendency in U.S.A. recently to reduce the amount of black setup to 5 IRE scale units in order to gain an additional 5% in the video voltage range and therefore the picture tone range. This seems an odd approach to the problem when it is considered that TV production groups frequently throw away as much as 15 to 20% of the possible video voltage range by allowing glint spikes to be used as white references. Dropping the setup also introduces secondary problems when the signal has to be processed for retransmission.

Where program feeds from a number of sources must be mixed, problems of matching setup may occur. This is particularly so when some of the material originates locally and some arrives after transit over several thousand miles of microwave network. The latter signal must be processed to clean up the synchronizing signals and not all processing amplifiers are capable of reintroducing setup.

To introduce deliberately peaks in the scene, when shooting films for television, creates a problem slightly different from the live studio operation. It has already been mentioned that the nature of motion-picture processes provides some peak limiting. This tends to eliminate the fine spikes from "glints" as was shown in

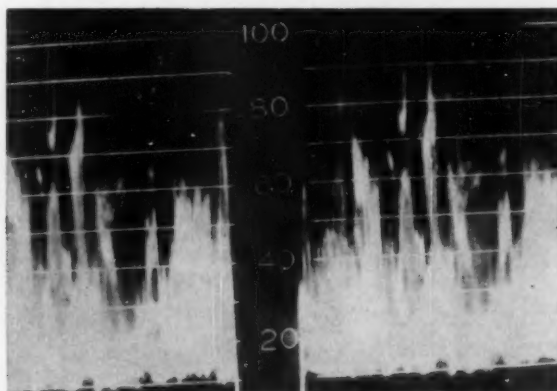


Fig. 16. Typical line rate waveform from a live TV studio using image orthicon cameras. Note the difference in glint spike content between Fig. 15 and 16.



Fig. 17(a). Scene from musical variety program.

Fig. 15. If the film is being made indoors, by means of artificial light, the method used for introduction of white peaks is similar to that used in the television studio. Adequate control of lighting and sensible choices in properties and costumes may be made to provide the necessary references.

When films are exposed out of doors, serious difficulties immediately develop. Far from having a problem in obtaining a white reference, the production group will find they usually have too much of it. The open sky has very high luminance and even higher luminances will result from white cumulus clouds or white painted houses in direct sunlight. If the action and the faces are also illuminated by direct sunlight the problem is not so serious, but many times the action may be occurring in partial or complete shade from objects such as buildings or trees. The luminance difference between sky and faces will be so great that the re-

sulting density difference in the finished film will force the faces so close to black-level voltage that the features and detail will be lost. This has been illustrated in another paper⁶ and may be seen almost every day on television. If the film was being shot for direct projection, the usual procedure would be to set the exposure to produce satisfactory rendition of the face tones. This would produce satisfactory results in direct projection, because the eye would concentrate on the center of interest (the faces) and ignore the peak produced by the white cloud or building. But when the same film is reproduced in telecine, the telecine camera operator will set the white peak at 100 IRE scale units and the face would be too dark.

Some of the solutions to this, such as sky filters, artificial fill light or reflectors have been commonly used by the motion-picture industry for many years, as a means of producing better pictures.



Fig. 17(c). Scene from low key drama.

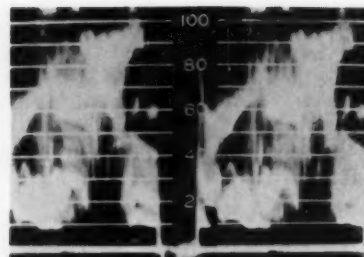


Fig. 17(b). Waveform for Fig. 17(a).

But a great misconception exists — that film which is satisfactory for theater projection should automatically be good on television. This is not so. Theater projection has never been particularly concerned with the *density spacing* between centers of interest and the minimum density on the print. This spacing is of prime concern to television because it is this, and not the actual face density, which determines how the face will look on telecine.

Black peaks are not quite so much of a problem in telefilm production, because current commercial telecine chains are relatively insensitive to changes in density at the dense end of a telefilm print. This has also been detailed in a previous paper.⁶

This rather lengthy discussion of black and white references may have left the impression that the author is suggesting that they should be in every shot. This is not so. They should be present as frequently as possible, ideally in every shot. But it would be unrealistic to expect them in every shot in every type of program. For example a close-up shot of a brunette performer in a dark dress might well be completely lacking in white references. But if this shot falls between two others having references in them, no experienced video technician is likely to be tempted into raising the gain on that particular shot.

In an attempt to maintain peak white levels for film, there has been a tendency in recent years toward the use of automatic gain control (AGC) or automatic sensitivity control (ASC) in telecine equipment. If a shot such as the one described above occurred on film, AGC would select the highest output, probably from the facial keylight highlight and raise it to 100 IRE scale units. This

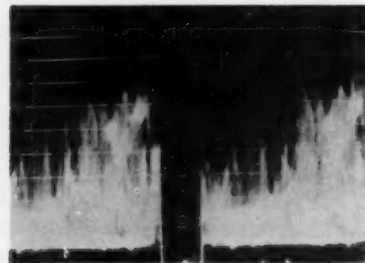


Fig. 17(d). Waveform for Fig. 17(c).

would wash out facial detail and destroy both form and mood. It seems significant that no one has suggested or permitted an AGC circuit in the output of a live network studio so far. And it has been shown that television film, if properly made for the TV medium, renders the use of either AGC or ASC circuits unnecessary.⁶

Face or Skin-Tone Voltage Levels

A discussion of reference black and white voltages leads logically to consideration of the video voltage levels for faces. Faces have a particular significance because they are predominantly the center of interest in much television programming. Female faces in particular are given a great deal of attention by makeup and lighting but most of this may be nullified if the other factors are not taken into account properly when setting or arriving at voltage levels for faces.

In CBC live studio practice, face levels may range between 50 IRE scale units and 80 IRE scale units. Levels higher than this tend toward washed-out detail and dimension, levels lower than this would be too dark. For most normal situations with fair-skinned people, such as panel and quiz programs, interviews and news, a good average level would be about 70 IRE scale units. This provides three EIA gray-scale steps difference between peak whites and faces.

There is not much difficulty in placing face levels correctly in live transmission because of the facility of immediate monitoring. In telefilm work it is more difficult because the results cannot be seen immediately. Methods of determining face voltage levels with accuracy while the film is being exposed have been detailed in another paper,⁶ but it is repeated here that in motion-picture film for television it is useless to consider the print densities for faces without also considering the minimum densities in the print and the dynamic transfer characteristic of the reproducing device. The first problem will be taken into account in the new version of the SMPTE Recommended Practice RP-7, but the second problem is still unresolved. *There is no standard telecine reproducing characteristic.*

One of the commonest difficulties in telefilm is with face levels which are too low. Everyone is familiar with the dirty or even black appearance of faces as reproduced from some telefilm. This is particularly so where bright backgrounds are encountered. News film seems currently to be the worst offender in this respect; personalities in the news are often filmed with the camera facing into the sun!

One type of staging widely used by TV producers employs a jet black background. This causes the face to be surrounded by black and creates the familiar psychological visual effect where

the brightness of the face appears greater than it would be for a lighter surround. The effect of surrounds has been admirably described by Evans⁷ but is seldom taken into account by TV production groups. A slight reduction in video face levels, or a reduction in light level on the face without changing the lens aperture, would reduce the face brightness sufficiently to prevent it from having a hot white, or washed-out appearance. Too often the reverse is the case, where turning off the background lights is followed by turning on a pair of high-powered follow-spots.

Levels Relative to the Unrestored Receiver

In the past the broadcaster has done much soul-searching over the problem of the unrestored receiver. To satisfy properly a receiver which has no d-c restoration, all waveforms must be balanced about an imaginary center axis. Very low key and mood lighting are not well reproduced and long-shots against a dark background are very poor. To satisfy an unrestored receiver places an almost impossible burden of restriction on the producer. It would mean the production of a stream of pictures which all look alike. In recent times the attitude taken by CBC is that the pictures should have highest possible quality as evaluated on a properly adjusted control-room picture monitor with low ambient light. This is similar to the philosophy which has governed our radio broadcasting for many years. It has not always been the policy in television as indicated in a 1956 paper.⁴ In recent years, a number of engineers^{8,9} have published papers which show the seriousness of the problem. It has no parallel in motion-picture history, and is currently the most damaging factor to the esthetics of TV production. It is hoped that some solution may be found in the not too distant future.

Night and Day Scenes

The success of night scenes in television programming is dependent on maintenance of proper waveforms and waveform amplitudes. The peak-to-peak voltages for night scenes should be the same as those for day scenes. The difference lies in the distribution of voltages between black level and white level. The key to good night scenes in the live studio is in the distribution and areas of different tones. A changed shadow pattern within the scene, without changing the luminance range, will result in proper peak-to-peak voltages while creating the effect of nighttime when viewed subjectively on a properly adjusted picture monitor. In TV production, good night scenes do not mean the absence of light.

In the motion-picture industry, night scenes have often been shot in daylight, and a combination of negative under-

exposure and print timing adjustment has been used to create the subjective impression of nighttime. When this technique is attempted for telefilm shooting, the results are very poor. The restricted contrast range in the print gives rise to low video voltages. When the technician increases the gain in order to achieve usable levels, the noise increases to an intolerable extent and the scene may be converted back into a day scene in the process.

Some production groups have found that the best telefilm night scenes are those shot at night, with important scene elements lighted by artificial light to a luminance level which achieves a print density low enough to provide proper output from the telecine camera without excessive increases in gain and noise.

Normal Waveforms

In the author's opinion, "normal" waveforms are not synonymous with good waveforms, because a number of years' observation of picture levels in North America leads him to consider that levels are often incorrect, frequently too low and that video level setting practice in both network and commercial station operation is rather erratic.

The illustrations of Fig. 17 were chosen at random from some Canadian CBC productions, but could equally as easily have been chosen from other North American source. The only exception seems to be the monochrome portion of color transmissions, where levels are generally more uniform and consistent.

The pictures in Fig. 17 were taken with a Polaroid Land camera from a control-room monitor. The conversion through several generations of photography and lithography has produced some unavoidable black compression. The waveforms were copied from Polaroid Land originals where the exposure was made insufficient to register the fine spikes in the signal. This gives a better idea of the true levels which existed, because the nonessential peaks are not visible.

Figures 17(a) and (b) are from a musical variety program. The levels are fairly high, with the peaks clipped. Figures 17(c) and (d) are from a low-key drama. This would definitely be considered low level, because very little waveform display rises above 80 IRE scale units.

Abnormal Waveforms

Production groups often ask for a type of lighting, staging or shooting which produces waveforms and video levels little suited to TV network transmission or TV recording on either film or tape. One of the best examples of this is the limbo long-shot shown in Fig. 18. The resulting waveform shown in Fig. 19 is one which will aggravate all the defects in a transmission or recording system,



Fig. 18. The limbo long-shot.

with ringing, edging and streaking only a few of the possibilities.

Figure 20 shows a picture which produces a badly balanced waveform. There is a dominance of blacks and the waveform in Fig. 21 shows this. Such a shot is typical of those which reproduce poorly on an unrestored receiver.

Production groups frequently attempt a very low key lighting situation. While an occasional shot with lower than normal levels is acceptable, such conditions should not be prolonged or repeater points and recording rooms might be tempted to raise the gain. The worst example of this encountered by the author was a case where a drama producer had his program mood planned for very low key lighting. In rehearsals, levels were so low that the producer asked the crew to raise the monitor brightness so he could see what the cameras were doing! This is not low key. It is what R. S. O'Brien has called "just plain dim."

Another type of abnormal waveform is

produced by poor lighting and staging techniques which create a very limited tone scale range in the studio. This leads to a voltage display which lies in the middle of the scale, providing no clues as to correct adjustment of either gain or black level. Addition of suitable white and black references will cure this voltage level problem.

Critical Monitoring

As live studio and TV film techniques improve, and as equipment stability increases, the process of monitoring becomes more and more critical. This has already been reflected in the design and facilities of many network control rooms, where the older and smaller waveform monitors have been replaced by the larger and more versatile Tecktronix Model 525 or its equivalent. The technician is much concerned with video levels and their measurement and interpretation, but to the producer, these mean very little. He is concerned with the appearance of his program as evaluated on



Fig. 20. Poorly balanced picture.

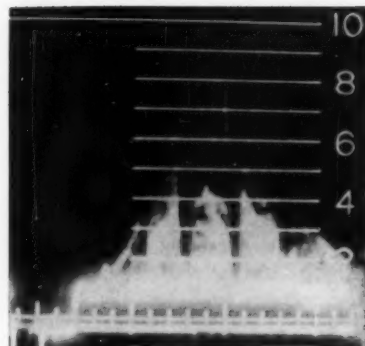


Fig. 19. Line rate waveform for Fig. 18. Note the low general level and bad balance.

the picture monitors. An unstable monitor will mean that the reference device used by producer, designer and lighting personnel, is, by its own drift characteristics, going to nullify many of the adjustments made to design and lighting. A misadjusted monitor could be equally misleading.

In recent years, motion-picture groups, agencies and film laboratories have become increasingly aware of the value of previewing their films on a telecine chain. Methods¹⁰ have been devised by CBC for standardizing the telecine chain, but few industry advances have been made which tend to increase the stability of the picture monitor. Like the studio producer, most of these groups are not concerned with the waveform, but are very much concerned with picture appearance. It is essential that the broadcaster be in a position to guarantee to such groups that the *subjective* aspect of their evaluation can always be made on a monitor which has the same day-to-day and control room-to-control room characteristics. The need for standardized monitoring conditions has always been heavily emphasized in the motion-picture industry. At many film production centers the screen luminance in review rooms is adjusted every morning by reference to a standard and by measurement with a spot photometer. In BBC telecasting operations, a special picture lineup generator produces a

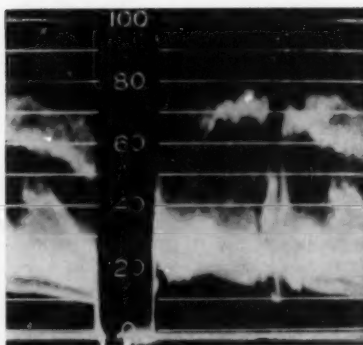


Fig. 21. Waveform for Fig. 20.

signal consisting of three vertical bars for a portion of the frame. The first bar is 5% below black, the second bar is 5% above black and the third bar is at peak white. The monitor is adjusted so that the first bar is made black without extinguishing the second bar. The third bar is used to set white luminance.

The previously mentioned CBC survey of current monitors and the techniques of their adjustment indicated that the following specifications are reasonable and realizable.

Ambient light	0.25 ft-c measured at the face of the monitor picture tube.
Peak-white luminance . . .	16.0 ft-L
Black-level luminance . . .	0.40 ft-L (at 10 IRE scale units)
Contrast	40:1

For uniform and acceptable critical monitoring the following requirements should be met.

(a) Ambient light must be kept to a uniform minimum.

(b) Some means must be used to ensure the same day-to-day and control room-to-control room picture monitor contrast range and peak white luminance.

(c) Picture-monitor video amplifiers must have linear amplitude characteristics.

(d) Each critical monitoring point should have one high-quality oscilloscope for waveform monitoring, with at least a 5-in. oscilloscope equipped with the IRE scale.

(e) A regular procedure for oscilloscope calibration must be adopted.

(f) The output of each studio should have a distortion-free white clipper and all clippers in a single plant should clip at the same video level.

(g) A rigid system of pre-program levels tests must be adopted, to ensure that peak-to-peak video voltages, as read on the studio control-room master oscilloscope, are the same at the input to the recorder and to the network.

(h) Operations personnel engaged in monitoring and video-levels adjustments must be thoroughly versed in the theories of waveform generation and the oscilloscope displays resulting therefrom.

Live Studio Video Levels

The problem of establishing satisfactory levels from a live studio is simplified, on rehearsed programs, since the production crew can pre-evaluate both the picture appearance and the voltage waveforms which give rise to it. Assuming a properly organized and operated studio, with equipment maintenance held to a high standard, the problems of levels usually define themselves in terms of staging, lighting and camera work. With understanding and cooperation between

the technical, design and production personnel, it should be possible to arrive at a coincidence between satisfactory transmission levels and satisfactory esthetics. But if picture monitors are misadjusted to give them high contrast ranges, a studio crew may delude themselves into thinking they have satisfactory levels when average levels are actually low. Enhanced contrast in the picture monitor is only increased video gain in that unit and in no way affects the condition of the transmission signal.

There is an increasing trend in TV camera equipment toward high stability and freedom from drift. This has led some operations groups to adopt a method of operation which leaves the responsibility for the production of adequate video levels with production, design and lighting. In other words, the camera electronic controls and lens apertures are set with reference to a studio step wedge or gray scale and the controls are not changed during rehearsals. The lighting crew then light to this standardized camera, evaluating the results on both picture and waveform monitors. This method of operation has been in partial use in some CBC studios for almost three years now, and when fully applied, results in a program feed requiring only minor adjustments to gain and black level. Its overall effect has been to influence the design of the new CBC Broadcasting Centres where all camera control units will be centrally located in a video equipment room. This philosophy seems to be spreading and similar approaches can be found in New Zealand and in some of the studios of the Columbia Broadcasting System in the U.S.A.

The previous discussions of glints and white clippers apply particularly to live studio operation where there is more likelihood of specular reflections and high resulting voltages. With a white clipper in operation, experience and common sense must be combined so that both objective and subjective judgment may be properly exercised when adjusting gain in respect to the white clipping level. Insufficient clipping will not achieve the improved tone scale performance previously referred to. Too much clipping will produce white saturation of highlight detail and the accompanying gain increase may bring the face tone voltages too high, causing loss of dimension and destruction of modeling lighting effects and makeup.

White clippers are an essential part of equipment used for TV pickup of sports activities, particularly hockey and boxing, where the constant popping of news camera flashbulbs introduces high-level transient white peaks sufficient to interfere with sync-locking equipment or produce the previously mentioned difficulties with VTR modulation.

Although the use of vidicon camera

tubes for live studio pickup is limited in CBC operations there is a growing trend toward their use in many stations. Because the vidicon transfer characteristic lacks the knee and AGC action of an image orthicon, overbright highlights and glints will produce very high level peaks in the signal. In order to maintain satisfactory tone-scale in the remainder of the picture, it is essential to have a white clipper in the output of a vidicon studio camera.

VTR Levels

A properly maintained video-tape recorder will have a unity transfer characteristic and the pictures derived from it during playback should be a reflection of the studio levels supplied to it. There is, however, one serious operational problem in respect to video levels. The tape-recording process is such that the demodulated video signal must be fed through a processing amplifier to clean up the sync signals. This amplifier provides individual gain, or level controls for the sync, setup and video portions of the composite signal. The playback operator has no references for setup or video levels and must set them subjectively by reference to the monitoring oscilloscope and the picture monitor. It may be very difficult for him to decide what is the correct level. Introduction of keyed-in staircase voltages on the vertical back porch will not help, because re-introduction of blanking in the processing amplifier will remove the reference staircase.

If levels from the studio are good, with frequently recurring black and white references, then playback will be less difficult and the reproduced program will have good picture contrast.

In CBC practice, programs which are pre-recorded by the VTR process, for later release to the network, are preceded by a staircase signal with correct peak amplitude and setup. When the playback occurs, the staircase provides an easy reference for the operator when setting levels on the processing amplifier. This does not solve the network time zone delay problem because the staircase is seen only by the playback operator and is not fed to the network. Thus it will not be available to the network delay center playback operator who may be several thousand miles distant from the original playback.

Television Film Recording Levels

When all the elements of the TV film recording process are properly controlled and the various transfer characteristics arranged to be complementary to each other and to the telecine reproducer characteristic, a condition extremely close to a unity transfer characteristic may be achieved. The methods of achieving this have been described in papers by Ross.¹¹

The problem of white nonessential peaks is not so serious here because the nature of the television film recording process is such that they are reduced or eliminated. Nonessential spikes may be allowed to exceed 100 IRE scale units without ill effects in a negative-positive recording system which uses contact printing. From a tone-scale viewpoint, therefore, the TV film recording will also be a reflection of studio practice when reproduced on a telecine camera.

Television Film Levels (Telecine)

Consideration of video levels from film can only be in reference to the densities and therefore to the light transmission factors of the various image elements in the scene. This is because all these various levels of light transmission are converted into voltage levels by the telecine reproducer. Unlike a human observer, who, watching a film projected onto a screen, will concentrate on centers of interest and ignore many of the high-light or deep shadow elements, the telecine chain "sees" all the densities on the film, unless they encompass an area so tiny that the bandwidth limiting factors cause them not to be reproduced.

There have been many attempts in the past to describe television film characteristics by using the expression "significant areas." The expression has no meaning in television film because there is no way in which it can be related to video voltage and video levels. This is particularly so in 16mm work. If, by examination of a 16mm TV film frame, several people had to decide which was a significant light-toned or dark-toned area, they would undoubtedly come up with several different choices. Even if they could agree, how are these to be measured on a 16mm frame? Nothing short of a microdensitometer will do it and such instruments are not commonly found in either the lab or the TV station.

On the other hand, peak densities, or the extremes of density, have some meaning, because they are responsible for the generation of peak voltages, and these peaks may be seen on the telecine waveform monitor oscilloscope. If the telecine chain is precalibrated, by using a calibrated staircase test slide and beam setting window slide, as described in a previous paper by Murch,¹² then the density peaks may be read directly from the oscilloscope.

The maximum density in the film will produce reference black level and the minimum density in the film will produce peak or reference white level. There does not seem to be nearly such a serious problem with glints when using the film process. Most television prints, particularly 16mm prints, are several generations removed from the original negative. Since the glints are usually in fine-detail form, the various film processes,

particularly contact printing, combined with the resolution limiting action of the camera tube scanning beam, appears to diminish or subdue them to an extent where they do not interfere with the normal processes of level setting.

The problem created when telefilm is made without taking into account its ability to generate video voltages is a serious one. The video technician is placed in the difficult position of having to make a subjective decision as to how the picture should appear. Attention has been drawn to this in a previous paper by Ross.¹³

When the telecine output from a film appears on the picture and waveform monitor, the video technician must decide on the level setting for black peaks, the level setting for white peaks and whether any clipping will be used on either blacks or whites. It requires only a small number of variables such as this to produce an infinite number of combinations and results. What the technician cannot know is the original intent of the producer, and in addition such decisions must be made very rapidly. The need for black and white references and constant density ranges is well justified in this situation.

TV Slide Levels

The widespread use of 2 by 2-in. slides for commercials, promotions, station breaks, etc., poses an interesting video levels problem. Such slides usually appear in groups during station-break and network-break periods. They may come from a number of different sources and are usually "punched" up by the operator in a fairly rapid sequence. If the slides have a variety of density ranges, there will be sharp shifts in video levels, resulting in a very "bouncy" station-break presentation. There is not time for the video technician to make gain and black level adjustments between slide changes. In the CBC English network production center in Toronto, this problem has been solved by referring all stages of the production of slides back to the telecine reproducing characteristic indicated in the paper by Murch.¹² This has resulted in a reference conversion scale which the artists consult when preparing artwork for conversion into slides. A Kodak Model RT densitometer is used for artwork reflection density measurements and finished slide transmission density measurements. Still lab exposure and processing are held constant and any tendency to drift is controlled by regular density measurements. A group of these slides may be "punched" up in rapid sequence without the need for gain and black level adjustments, because their constant density range results in constant video levels.

When SMPTE Recommended Practice RP-7 is finalized and accepted, there will be a target for slide producers to

meet and broadcasting groups will be in a better position to insist that the recommendation be met.

Summary and Recommendations

The monitoring, interpretation and adjustment of video levels is not a simple problem because it relates directly to all phases of production technique. Like the monitoring of audio levels, it is a combination of subjective evaluation and objective measuring techniques. Used with care and attention to many small details, present equipment is capable of providing a reasonable monitoring condition, but there is much room for improvement and a great need for recommended practices and standards which have international acceptance.

Any well-run broadcasting organization can and will set its own standards, but in these days of increasing international exchange of programs, it is highly desirable that such standards be set by committee operation, preferably international in character. If this is not done, then we will have a situation, to use an analogy, where one factory is making bolts and another one is making nuts which will not fit the bolts.

The following recommendations are offered as a partial possible solution to present inconsistencies in monitoring equipment and procedures.

(1) It would be desirable, perhaps through the Joint Committee on Inter-Society Co-ordination in the U.S.A. to complete and correlate the work done to date by the various standardizing groups such as IRE, EIA and NAB.

(2) Some of the targets for this work should be:

(a) a recommended practice for TV control-room ambient illumination;

(b) a complete specification for the television waveform monitor (This would include transient response, stability, linearity, methods of calibration and recommended practices for reading.);

(c) a more complete specification for picture monitors which would include (i) a specification for picture tube phosphor emission chromaticity, (ii) degree of permissible interaction between controls, (iii) stability relative to line voltage variations, and (iv) recommended practices for adjustment and peak white luminance level (assuming controlled ambient light);

(d) a re-examination of standards for setup in monochrome TV operations;

(e) a recommended practice for image-orthicon exposure adjustment; and

(f) a standardized telecine reproducing characteristic.

The motion-picture industry, over a period of many years, has perfected its techniques and improved its equipment to the point where film entertainment, in

the better theaters, is practically flawless from the viewpoint of quality. Through a continued and well-developed program of standards and standards development, international exchange of motion pictures has had few difficulties, apart from language problems.

If television is to survive as a satisfactory medium for the arts, if it is to develop, grow and mature, then technical problems of the type described in this paper, so damaging and restrictive to the esthetics of the medium, should receive concerted study and attention by the networks, film production groups and receiver manufacturers. If they are not studied and overcome, television will remain a primitive and rather crude medium.

The author wishes to acknowledge the advice and assistance of the many Engineers and Operations Supervisors in CBC, who took time to read and comment on this paper while it was in preparation.

References

1. IRE Standard 58 IRE 23.S1 "IRE Standards on Television: Measurement of Luminance Signal Levels, 1958", *Proc. IRE*, 46: no. 2, Feb. 1958.
2. CBC Engineering Standard Ref: 5.2.7-2 "Amplitude Calibration of 525 Waveform Monitors and 524 Oscilloscope."
3. EIA Standard RS-170 Nov. 1957 "Electrical Performance Standards — Monochrome Television Studio Facilities."
4. Harold Wright, "Television studio practices relative to kinescope recording", *Jour. SMPTE*, 65: 1-6, Jan. 1956.
5. J. R. Popkin-Clurman and Frank Davidoff, "A Deleter-Adder Unit for TV vertical interval test signals." 1959 IRE National Convention Record, Part 7.
6. Harold Wright, "An engineering approach to television film — Part II: Telefilm density and exposure control," *Jour. SMPTE*, 68: 744-756, Nov. 1959.
7. Ralph M. Evans, *An Introduction to Color*, John Wiley & Sons, New York, 1948.
8. R. G. Neuhauser, "Black level — the lost ingredient in television picture fidelity," *Jour. SMPTE*, 66: 597-601, Oct. 1957.
9. Robert J. Nissen, "The problem of the un-restored television receiver," *Jour. SMPTE*, 69: 521-527, Aug. 1960.
10. CBC Engineering Standard Ref 4.2.5-3 "Vidicon Telecine Set-up Procedure."
11. Rodger J. Ross, "Exposure control in television film recording," *Jour. SMPTE*, 69: 580-586, Sept. 1960.
12. L. J. Murch, "An engineering approach to television film — Part I: Standardized gray-scale characteristic for vidicon telecine," *Jour. SMPTE*, 68: 740-743, Nov. 1959.
13. Rodger J. Ross, "Film in television," *Jour. SMPTE*, 67: 374-378, June 1958.

Discussion

K. R. Ackerman (British Broadcasting Corp., London, England): Relative to your reference to more stable monitors, I should point out that in the BBC with the "hands off" technique monitors are set up on test waveforms each day and tested for white level, maximum brightness and everything else — in other words set up on a specific waveform. This is absolutely essential, of course, to the "hands off" technique. I would like to make the point, if I may, that we must beware of being overconscious of the one-volt vision output signal. It seems to me what we ought to aim at is the point you have made: standardization of setting-up procedures, and of the characteristics of our equipment.

Our eventual aim would be to get waveform monitors out of the operation altogether. The pictures will be assessed on the picture tube. It is, after all, an artistic medium. In other words, we must try and standardize our technical procedures — set up everything in the maintenance room before the rehearsal starts. Then don't touch gain or any other control (except perhaps iris), all pictorial changes being carried out by lighting — during the rehearsal and transmission

period. And if the system is stable and properly set up the artists can then have their way and compose their pictures. It's true, mind you, that they must have a line-fed domestic receiver as well so that they are reminded to give a reasonable amount of a-c content to the picture for the average home viewer.

Mr. Wright: I agree with you completely on the philosophy behind what you say. I understand that you have commercial monitors and wonder whether you have modified them in any way by applying voltage regulation or other means to make them more stable? I mention this because we found, in setting monitors up with any type of standard procedure, such as step-wedges, that they just will not maintain their adjustments through a period of rehearsals.

I think perhaps the day may come when we may work from picture monitors, and I hope I wasn't implying that I always expect every shot in every scene to have one volt peak-to-peak. What we do try to strive for is to see these crop up as often as possible so that people playing back video-tape delay recordings and other recordings won't be tempted into fiddling with the gain — at the time the recording is played back.

Mr. Ackerman: At the vision control position we use high-grade technical monitors with stabilized power supplies and find it sufficient to check the monitors at the beginning of the day and just prior to transmission. Standard commercial monitors are only used in less critical parts of the control chain.

Mr. Wright: I think that most of the networks are in agreement on the philosophy here. I think our main problem is equipment stability and equipment standardization.

K. Blair Benson, Session Chairman: If there are no other questions from the floor, I might add one point that may be of interest: In line with the standardization of equipment adjustment, the Columbia Broadcasting System at the present time is installing white reference level generators in all studios and on all film chains, to insert a white reference pulse in the vertical interval. In addition, CBS is installing white clippers in the outputs of all studios, to enforce standard adjustment of the equipment. This is apart from the artistic feature which Mr. Ackerman spoke of.

Shutter-Bar in Television Film Recording

By C. H. EVANS

Conversion from the rate of 60 television fields per second to 24 film frames per second in television recording is generally accomplished by omitting from the record every fifth consecutive half-field. Consequently, there is a picture splice across the center of every other film frame. In a camera having a properly adjusted mechanical shutter, all points of the picture receive the correct total exposure. However, the exposure intensity and time relationships differ for points inside and outside the splice, and this can lead to a density difference across the splice. This form of shutter-bar has been eliminated in the new experimental recording film described.

Introduction

The appearance of "shutter-bar" at the "picture splice" in alternate film frames has been a major problem of television recording in the United States and other countries employing a 60-cycle television field rate (30-cycle frame rate). To produce standard motion-picture film for projection at the rate of 24 frames/sec by photographing a television picture presented at 60 fields/sec it is customary to leave unrecorded two half-fields out of every five television fields, as illustrated in Fig. 1.

In a properly phased system one film frame is used to record two complete, successive interlaced television fields. A shutter then covers the film before it is advanced to the next frame by an intermittent pulldown mechanism. After the film has been advanced, the shutter reopens at the middle of the third television field, recording the bottom half of the picture presented in this field. It remains open to record the entire fourth field and also the upper half of the picture in the fifth field. When this field has been traced down to fill in exactly that portion of the picture left unrecorded during the first half of the third field, the shutter again closes, and the film is pulled down to its third frame. The shutter opens again at the beginning of the sixth television field, and the exposure pattern repeats, although this time the even and odd fields are recorded in reverse order. At the fifth film frame, conditions are the same as at the first (leaving subject motion out of consideration).

Thus, in alternate film frames, either the odd- or even-numbered television lines in the bottom half of the picture are recorded from one television field and the corresponding lines of the upper half of the picture are recorded from the second field following it. Very precise adjustment is required to join the two

halves of the picture in this manner. The horizontal zone in which the two halves join is called the "picture splice," or simply the "splice," and a motion-picture frame containing such a splice is a "spliced frame." Various types of visible disturbance which may appear at the splice are collectively called "shutter-bar." For example, if the shutter opening is too large, some lines will be overexposed, and a dark bar will appear at the picture splice in the negative. Shutter-bar has been discussed at some length by several authors, and attention has been drawn to the very precise setting of shutter angle which is required to eliminate it.^{1,2,3}

In the present paper, attention is called to a particular type of disturbance in the picture splice which can appear even though all of the recorded television lines in the film frame receive exactly equal amounts of exposure. When the effect occurs, either the upper or the lower half of the spliced frame may appear darker than the other half. This phenomenon is relatively independent of the angular size of the shutter, and can be more pronounced than other contributions to shutter-bar. In the following sections it will be shown that the effect

depends upon the reciprocity-failure characteristic of the recording film.

Analysis of Exposure Conditions

It will be shown first that with an optically and mechanically perfect recording system, each of the recorded lines on the film receives exactly the same total exposure in both the spliced and the unspliced frames, when an unmodulated television raster is recorded. In any practical system, of course, the lens will cause some decrease in exposure at the corners, there will be variations caused by inhomogeneities of the phosphor screen in the picture tube, and so on. Such factors are not relevant to the discussion and will be neglected in the rest of this paper.

When an unmodulated raster is presented on a picture tube, phosphor excitation and decay soon reach a steady state and, regardless of the exact form of the excitation and decay curves, the luminance of a given point on any television line is cyclic with a period of 1/30 sec. This is the time between successive transits of the electron beam past that spot. The amplitude and the waveform of the cyclic variation are the same at every point on the raster, but the phase differs progressively from point to point because the lines are traced out sequentially by the electron beam. In Fig. 2 there is sketched the approximate waveform of illuminance on the film vs. time, which might be expected of the P11 phosphor. The parts of the curve drawn with a dashed line indicate light which does not reach the film because it is intercepted by the closed shutter. It is assumed that a spliced frame is being exposed, and the shutter opens and closes

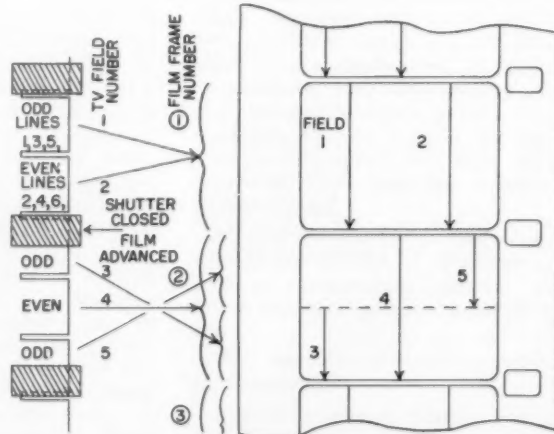


Fig. 1. Television recording. Conversion from the rate of 30 television frames/sec to 24 film frames/sec.

Communication No. 2157 from the Kodak Research Laboratories, presented on May 11, 1961, at the Society's Convention in Toronto by C. H. Evans, Research Laboratories, Eastman Kodak Co., Rochester 4, N.Y.
(This paper was received on September 22, 1961.)

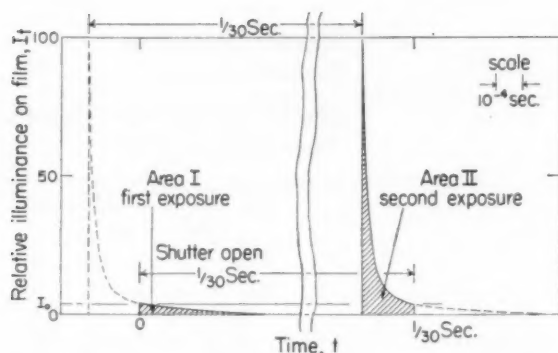


Fig. 2. Exposure sequence for a particular point of the picture, lying in the picture splice. Idealized mechanical shutter, opening and closing instantaneously.

instantaneously just when a line at the center of the picture is being scanned. The finite time actually required to open and close the shutter will be taken into account later.

At the moment when the shutter opens, some points of the phosphor lying above the center are still emitting light because the phosphor emission has a finite decay time. The luminance varies from point to point of the raster, falling off toward the top of the picture according to the elapsed time since the phosphor was excited by the scanning beam of electrons. This afterglow soon dies away, meanwhile delivering exposure to corresponding points of the film. These same points receive a second exposure when the phosphor is re-excited just prior to the closing of the shutter. Meanwhile other points of the image receive all of their exposure in a single installment because for them the entire excitation and decay of luminescence occurs with the shutter open. The amount of exposure, intensity multiplied by time, received in this single installment is obviously given by the area under one cycle of the illuminance curve. With the aid of Fig. 2 it may be seen that the same is true of the exposure in two installments, provided that the open period of the shutter is exactly $1/30$ sec.

Figure 2 applies to a point lying three television field lines (six interlaced lines) above the center of the picture; a point excited by the electron beam about 0.2 msec before the shutter opens. When the shutter opens, the luminance of the phosphor at this point has already fallen from its peak, and exposure of the corresponding point on the film starts at illuminance I_0 . The illuminance continues to drop toward zero and the exposure received by the point on the film during this decay is measured by Area I of the figure. There follows a period of time during which the point receives no exposure, but just before the shutter closes a second exposure is received, measured by Area II. Since the shutter is open for

exactly the $1/30$ -sec period of the phosphor luminance cycle, Area I plus Area II is just equal to the total area under the illuminance curve. We have already noted that this is precisely the exposure received by those points of the film which are exposed only once.

The entire portion of the picture whose points receive their exposure in two installments comprises the picture splice. Points near the top of the splice receive only a slight first exposure, followed by a relatively heavy second exposure. For points closer to the center of the picture, the first exposure becomes progressively heavier until right at the center the second exposure falls away to zero. The total exposure of each point, however, is the same as that of every other point. It is interesting that small variations of the shutter open period from $1/30$ sec can affect exposure on the film only in the picture splice. At other points, the shutter is completely open during the entire exposure and thus does not influence the amount of exposure.

So far it has been assumed that the shutter opens and closes instantaneously, whereas in fact several television lines are scanned during the time it takes the edge of the shutter to cut the light beam on or off. This comes about because light from a single point on the recording tube converges in a cone from the camera lens to a single point on the film. The cone has a relatively large cross section at the plane of the shutter, as shown in somewhat exaggerated form in Fig. 3. The time required for the edge of the shutter to traverse the beam varies with velocity of the shutter edge, cone angle (determined by image magnification and lens stop), and distance from shutter to film. A typical value is about 0.5 msec.

We shall now examine in some detail the course of the exposure delivered to a specific point in the picture splice. At any instant, the illuminance on that point of the film is determined by two factors: the transmittance of the shutter as viewed

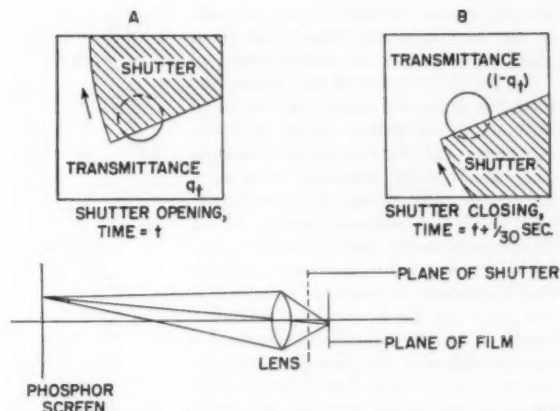


Fig. 3. Opening and closing phases of a practical mechanical shutter seen from a fixed point of the image. Time interval between views A and B, $1/30$ sec.

from that point at that instant and the simultaneous value of the illuminance which would fall at the point if the shutter were removed. At A in Fig. 3, the shutter is opening and the instantaneous transmittance is, by definition, q_t , that fraction of the total flux in the light beam which is passed by the shutter. The shutter rotates at the rate of 24 revolutions/sec, corresponding to the film-frame rate, and the shutter blade covers 72° of one 360° rotation. Therefore the open period of the shutter is $1/30$ sec. This means that the leading edge of the shutter blade always occupies the exact position that was occupied by the trailing edge of the blade $1/30$ sec earlier. At B, Fig. 3, the shutter is shown $1/30$ sec later than at A. Because exactly that portion of the light beam which was uncovered at A is covered at B, the transmittance at B (at time $t + 1/30$ sec) is $(1 - q_t)$.

In Fig. 4, it is shown that the total exposure delivered to the point on the film is the same as though the shutter opened and closed instantaneously. As in Fig. 2, the diagram is drawn for a point lying three television field lines above the center of the picture. The origin of time, $t = 0$, is taken when the shutter is exactly half open as viewed from that point. However, events taking place at time t and at time $(t + 1/30)$ sec are drawn superposed in the diagram to show the interrelationships more clearly. Accordingly, the origin is marked "0" and also " $1/30$." Other times are shown as plus and minus values from these indices. It has been assumed that the time required for the edge of the shutter to traverse the light beam is 0.5 msec.

The transmittance of the shutter as a function of time is shown at the top of the figure. The solid line represents the opening phase of the shutter (times around 0) and the dashed line its closing phase (times around $1/30$). For the selected image point, the shutter starts to open about $60 \mu\text{sec}$ before the corresponding point of the phosphor is excited by the

electron beam, but even so, a great part of the excitation and decay has taken place before the shutter is half open.

In the lower part of the figure, the solid line shows the product of the transmittance of the shutter during its opening phase and the illuminance (dashed line) which would prevail if there were no shutter. The shaded area under the solid line is the integrated product of net illuminance on the film by the time during which it acts. In other words, it is the first installment of exposure received by the point on the film. There follows a time during which the point receives no exposure because the phosphor afterglow has decayed to zero. Just $1/30$ sec after its initial excitation, however, the point on the phosphor is re-excited to the same peak intensity. This occurs $60 \mu\text{sec}$ after the shutter has started to close, but the shutter is not entirely closed until decay of phosphorescence is nearly complete. During this time the second installment of exposure is delivered.

In Fig. 4, the same curve (dashed line) which represented the excitation and decay around zero time now represents this function around $1/30$ sec. According to Fig. 3, at time $(t + 1/30)$ sec the transmittance of the shutter is equal to $(1 - q_t)$. Therefore, during the closing phase of the shutter, the product of shutter transmittance and the illuminance which would prevail if there were no shutter is given by the ordinate of the dashed-line curve, measured not from the axis, but from the solid line representing the first exposure. The second installment of exposure is represented by the area between the dashed line and the solid line.

This is shown more clearly in the enlarged view at the right side of Fig. 4; I_t is the ordinate of the illuminance curve (without shutter) at time t and at time $(t + 1/30)$ sec. For each increment of exposure delivered during the opening of the shutter, $q_t \cdot I_t \cdot dt$ (Area 1), there is a complementary second increment of exposure $(1 - q_t) \cdot I_t \cdot dt$ (Area 2) delivered during the closing of the shutter, and the sum of these two is just $I_t \cdot dt$. The integrated exposure received by the point on the film is therefore equal to the area under one cycle of the illuminance curve with shutter entirely open, just as in the previously assumed case of an instantaneous shutter.

This result is quite general for all points of the raster and is independent of the exact shape of the phosphor excitation and decay curve as well as the transmittance curve followed by the shutter upon opening. It is essential, however, that the phosphor excitation and decay have reached a steady, repetitive state and that the closing edge of the shutter coincides exactly with its opening edge as viewed $1/30$ sec earlier. Details of the exposure do depend upon the type of phosphor. For example, if decay time is

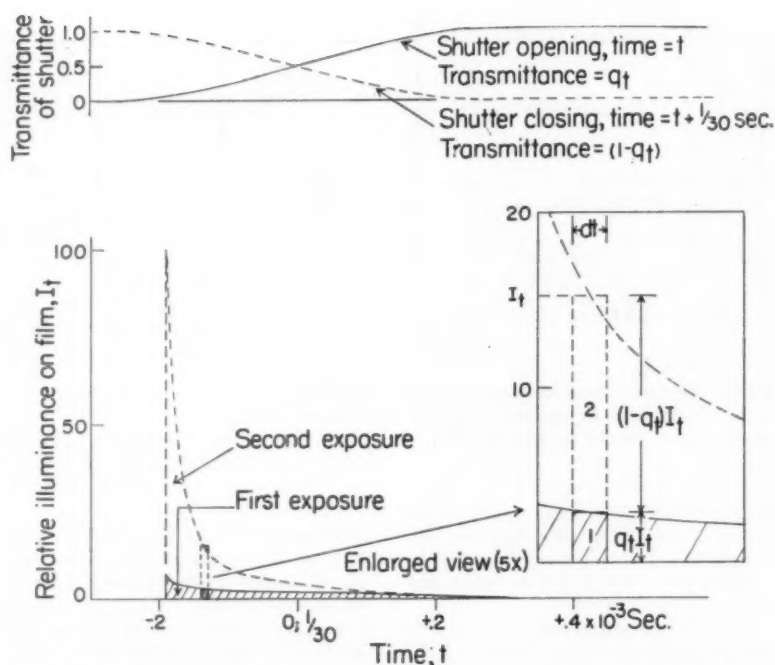


Fig. 4. Figure 2 redrawn for a practical shutter whose edge cuts through the light beam in 0.5 millisecond.

longer than $1/30$ sec, then all points of the image will receive exposure continuously during the entire open period of the shutter, but the exact manner in which the exposure is delivered (accumulated exposure vs. time) will vary from point to point, even though the final value of total exposure is the same for all points.

It has now been shown that all of the recorded raster lines receive the same total exposure, but with the short-persistence phosphors generally used for high-quality recording, lines in the overlapping picture splice receive the exposure in two installments. As a result, the density of these lines is likely to differ from that of the lines receiving their exposure in a single installment. This is a consequence of the reciprocity-failure characteristic of the recording film.

The Reciprocity-Failure Characteristic and the Intermittency Effect

The response of a photographic material to light is most often shown graphically, optical density being plotted against the logarithm of the product $(I \cdot t)$ of illuminance and exposure time. However, the density is a function not only of the product $I \cdot t$, but also of the absolute value of exposure time t (or illuminance I). This may be shown by a curve like that of Fig. 5, where the value of $\log I \cdot t$ required to produce a specified density is plotted as function of $\log I$. On such a diagram any fixed exposure time can be represented by a straight line of slope 1.0. In Fig. 5 the line labelled " 10^{-3} " for

example, is the locus of exposures at a 10^{-3} -sec exposure time.

In photographic literature, characteristic curves of this type have come to be called "reciprocity-failure" curves because they show the departure from the reciprocal relationship $I \cdot t = \text{constant}$, which is required to produce the given density. This terminology, though firmly entrenched, is unfortunate because in the minds of many people it connotes an abnormality or deficiency of the particular film, whereas in fact the reciprocal relationship does not hold for any film, for all values of I and t . This is fundamental, dependent upon the interplay between electronic and ionic processes in the crystalline silver halide grains during latent-image formation.

For each density level there is a value of intensity (and a corresponding exposure time) which is optimum, in the sense that the required exposure is minimum at that point. In the case of Film A, the optimum lies outside the range covered by Fig. 5, at a longer exposure time. The increase of $I \cdot t$ required to produce the given density at exposure times shorter than optimum (higher intensities) is called "high-intensity" reciprocity failure, and the increase at longer exposure times is termed "low-intensity" reciprocity failure. The degree of departure from a reciprocal relationship between I and t over a given range of exposure times, and also the location of the optimum point, vary somewhat from one type of film emulsion to another. It is therefore sometimes possible

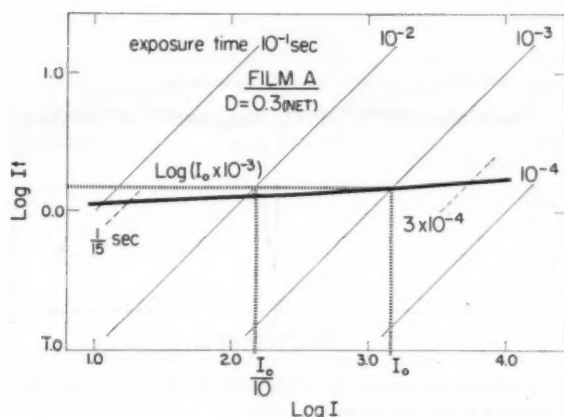


Fig. 5. Reciprocity-failure curve, Film A. Net density = 0.3.

to compound a film which requires little or no departure from the reciprocal relationship over a specified, limited range of I and t , in order to produce a constant density.

Another well-known photographic phenomenon is the intermittency effect. An exposure delivered in several separate installments generally yields a density differing from that obtained with a single continuous exposure of the same value, $I \cdot t$. The density resulting from the intermittent exposure may be either higher or lower than that from the continuous exposure. Webb⁴ and others have shown that the intermittency effect is a manifestation of the reciprocity-failure characteristic.

As may be seen in Fig. 5, an intensity level I_0 is required to produce a net density $D = 0.3$ with a continuous exposure lasting 10^{-3} sec ($I \cdot t = I_0 \cdot 10^{-3}$). Such an exposure is diagrammed in Fig. 6(A). An experiment can be performed in which an equal total exposure is delivered in n separate flashes, each of intensity I_0/n . For example, the flashes can be in the form of periodic square pulses with a duty cycle of $1/10$, as shown in Fig. 6(B). By exposing for 10^{-2} sec, at a pulse repetition period which is the n th submultiple of 10^{-2} sec, we will deliver the total exposure $I_0 \cdot 10^{-3}$ in n equal installments (the exposure is gated to start at the rise of the first pulse). The total active exposure time during the pulsed exposure is the number of flashes multiplied by the duration of each flash. Therefore, the total exposure E is given by

$$E = n \cdot \left[\frac{1}{10} \left(\frac{10^{-2}}{n} \right) \right] I_0 = I_0 \cdot 10^{-3}.$$

For the pulsed exposure shown in Fig. 6(B), $n = 5$.

It has been found that the density resulting from a pulsed exposure depends upon the pulse repetition rate, or frequency, becoming constant above a certain critical frequency which depends upon the type of film emulsion. Above the critical frequency, the resulting den-

sity of the intermittent exposure is equal to that of a continuous exposure of the same overall duration delivered at the average intensity level of the intermittent exposure (Fig. 6(C)). In our example (Fig. 5), this would be a continuous exposure of 10^{-2} sec at an intensity $I_0/10$ (total exposure $= I_0 \cdot 10^{-3}$). It can be seen from Fig. 5 that the resulting density would be greater than 0.3 (net) because $I_0 \cdot 10^{-3}$ is the exposure required to produce a net density of 0.3 at an exposure time of 10^{-3} sec, and according to the curve an exposure at 10^{-2} sec is more efficient, requiring a lower value of $I \cdot t$ to produce the given density. Although identity with continuous exposure at $I_0/10$ is achieved only above a certain critical frequency, it is important to note that the transition from effective intensity I_0 to $I_0/10$ takes place gradually. In particular, the density obtained with only two flashes may be intermediate between the two end values of density.

We are now in position to make a prediction from the curve of Fig. 5, relative to half-frame density differences to be expected in television recording on Film A. For P11 phosphor, handbook values of the decay characteristic indicate an effective exposure time of, roughly, $3 \cdot 10^{-4}$ sec for points receiving a single continuous exposure. In a pulsed-light, inter-

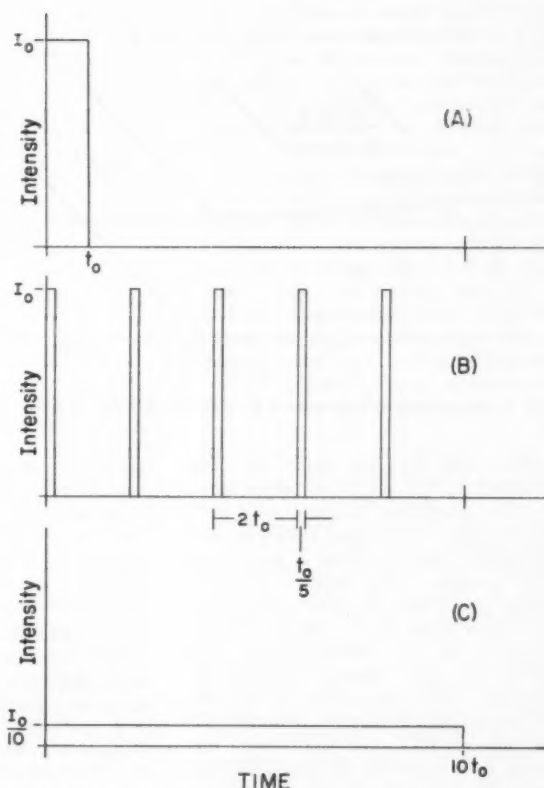


Fig. 6. Equal energy exposures: A, continuous exposure lasting t_0 sec at intensity I_0 ; B, intermittent exposure, duty cycle $1/10$, overall exposure time $10 t_0$; intensity of each flash $I_0/10$; C, continuous exposure lasting $10 t_0$ sec at intensity $I_0/10$.

mittent-exposure experiment, with two installments delivered $1/30$ sec apart (as they are in television recording for points in the picture splice), two complete cycles of the pulsed exposure would last $2 \cdot 1/30$, or $1/15$ sec. We are therefore interested in that part of the reciprocity-failure characteristic between exposure times of about $3 \cdot 10^{-4}$ and $1/15$ sec, shown by dashed lines in Fig. 5. In the spliced frame of a television recording, the two-installment exposures lie above the center of the picture, the actual height of the splice area depending upon the persistence of the phosphor. Since an exposure at $1/15$ sec is more efficient for Film A than an exposure at $3 \cdot 10^{-4}$ sec, it is to be expected that the two-installment exposures in the spliced frame will be more efficient than the continuous exposures. In other words, the upper part of the recorded picture negative on Film A should be darker than the bottom part. This is actually found in practice.

An example of a different behavior is shown in the curve of Fig. 7, for Film B. The optimum exposure time is close to 10^{-4} sec, and at longer times there is low-intensity reciprocity failure. An analysis similar to that already performed for Film A shows that, in the spliced frame of a television recording on Film B, the upper part of the negative should be

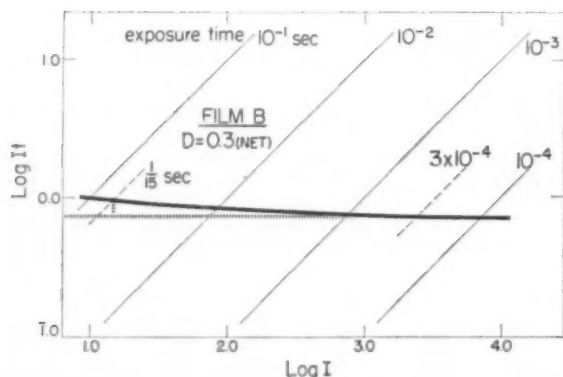


Fig. 7. Reciprocity-failure curve, Film B. Net density = 0.3.

lighter than the lower part. This, too, has been confirmed by direct experiment.

Two disturbing factors have been noted upon careful visual examination of recordings made on Films A and B with P11 phosphor. The density difference seems larger than we would expect, and the entire upper half of the picture appears to have a constant density. The latter is surprising because by computation the area receiving two installments of exposure in these experiments should extend only about one-eighth of the distance from center to the top of the picture. Microdensitometer studies of the frames containing a picture splice have resolved some of the difficulty. In the first place, the density difference is smaller than it appears to the eye; and in the second place, the density is *not* uniform throughout the top half of the picture.

Figure 8 shows a microdensitometer trace made on Film A (which shows a stronger density difference than Film B). The peak density in the splice is only about 0.04 higher than the density at each side of the splice. The density at the top of the spliced frame is the same as the density in the bottom half of the frame. The major disturbance at the splice extends approximately two-thirds of the distance from the center of the picture to the top. The visual effects which lead us to see something different are very interesting in themselves but they will not be discussed further here. It is emphasized, however, that the apparent density relationships seen upon visual examination of the film, either directly, by projection on a screen, or by television differ strongly from the true density relationships revealed by densitometry. We interpret the unexpectedly large distance over which the splice extends to mean that, under our conditions, the decay of luminescence of the P11 phosphor was a slower process than indicated by the handbook values used as the basis for Figs. 2 and 4.

Returning to a consideration of the causes of the measured density disturbances at the picture splice, we can be sure that the intermittency effect is not

operating here in its pure form. There are undoubtedly other mechanisms which come into play. For example, it is evident from Fig. 4 that the intensity level during each of the two exposure installments is less than the intensity received by the parts of the film which are exposed in a single installment. Thus, in the two-installment exposure, we start from a lower intensity level and there is a direct effect of reciprocity failure to which is added the intermittency effect. Further, it is known that the order in which two exposures, one at high intensity and the other at low intensity, are added on a piece of film can affect the resulting density.^{5,6} At most points in the splice region, the first exposure is followed by a second exposure at a higher average intensity, whereas outside the splice region the highest intensity occurs at the very beginning of the exposure period. The individual contributions of these various effects in television recording would be difficult to determine, but one fact seems to be clear, all of the effects are related either directly or indirectly to reciprocity failure.

Levelling the reciprocity-failure characteristic in the region from about 10^{-4} to 10^{-1} sec should therefore minimize half-frame density differences in recordings made with P11 phosphor. This approach has been followed in a series of experimental emulsions, with promising results. A very critical test for detecting the half-frame density difference is to make a television recording of a "staircase" signal, and to project the negative, or a print therefrom, on a screen, allowing simultaneous evaluation of the effect over the entire gamut of densities used in television recording. As a further refinement, the signal may be recorded at a series of shutter-blade angles. This has been done for several commercial recording films, and for the experimental films. Some degree of density difference was found in all of the commercial recording films, but for the best of the experimental films no density difference was detectable. Figure 9 is a microdensitometer trace taken along one of the density steps re-

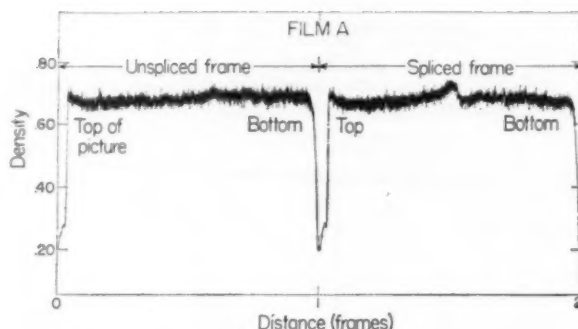


Fig. 8. Microdensitometer trace through spliced and unspliced frames of a television recording, Film A.

corded on this film (Film C). This is to be compared with Fig. 8, a similar trace from a commercial recording film.

High-intensity reciprocity failure can be reduced by using a silver halide solvent in the developer to render internal latent image available to the developing agents.⁷ A brief series of tests showed that addition of small amounts of hypo to the developer can greatly reduce the half-frame density difference on Film A. Little, if any, effect was noted on Film B. This is not surprising because, in television recording, Film B is operating in the region of its low-intensity reciprocity failure, whereas Film A is operating in the region of its high-intensity reciprocity failure.

It must be strongly emphasized that the reciprocity-failure characteristic is dependent on conditions of use, as shown by the example of solvent developers. Measuring reciprocity failure under conditions other than those employed for recording can therefore be misleading. Furthermore, the half-frame density difference in television recording appears to be a more sensitive indicator than the usual method of measurement.

Some interesting observations have been made during the course of our shutter-bar tests on many different films, with respect to the angle covered by the shutter blade (normally 72°). For example, visually observed half-frame density differences of relatively large magnitude are not affected by shutter-angle changes from 70.5° to 73.5° (the entire range covered in the experiment), although a relatively well-defined band near the center of the picture does change from dark to light relative to the rest of the picture. Furthermore, for a film exhibiting definite half-frame density differences, there is no setting of the shutter which will entirely eliminate a bar effect at the center of the picture. On the other hand, a film like Film C, which is free from the density difference effect, shows practically no bar effect at the center, even for shutter-angle changes covering a range of two or three tenths of a degree.

It is axiomatic in the television-record-

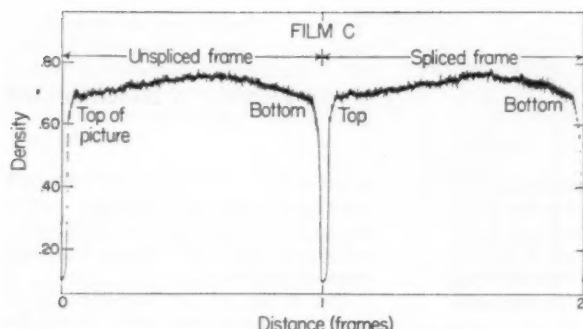


Fig. 9. Microdensitometer trace through spliced and unspliced frames of a television recording, Film C.

ing industry that the angular size of the shutter must be very carefully adjusted to eliminate shutter-bar. People speak of "less than the thickness of a coat of paint" on the edge of the shutter making a difference. Such experience is probably the result of trying to balance a slight density-difference effect against deliberate over- or underexposure in the splice region by sizing the shutter to something other than 72° . Since, in most cases, it is thought that the shutter blade should be sized a little over 72° (underexposure), the films in question were probably similar to Film A in showing greater efficiency to the interrupted exposure. This view is supported by the fact that, with a single exception (Film B), all of the formerly available blue-sensitive recording films which we have tested fall in this category.

Complete elimination of density deviations in the splice region by adjustment of shutter angle alone is not possible in the general case, for example, with Film A. One reason is that the reciprocity-failure characteristic differs somewhat with density level; another is related to the degree of exposure control exercised by the shutter. Above and below the splice, the shutter does not control the exposure at all. Within the splice, a given change in shutter angle adds or subtracts a fixed increment of exposure time, constant throughout all but the extremes of the splice region. The resultant percentage change of total exposure is minimum near the top of the splice because there the change in exposure time is associated with a low intensity level, in the tail of the phosphor-decay curve. The percentage change in exposure increases toward the center of the picture as the increment of exposure time progressively approaches coincidence with the peak emission of the phosphor. Although this is qualitatively the required pattern to correct a density change such as that shown in Fig. 8, it

would be coincidental if it were quantitatively what is required. We have found that even with distinct overcorrection for Film A at the center of the picture, there is not nearly enough correction at points higher in the picture.

The function of the mechanical shutter as just described is often taken over by an "electronic shutter." The mechanical shutter is removed, and the beam of electrons which excites the phosphor is turned on and off to establish the required exposure cycle. Thus, for the spliced frame, the beam is off during the first half of the first television field and then is suddenly turned on at the center of the picture. It remains on (except during blanking periods) until the top half of the third field has been traced, and then it is cut off. Because film pulldown must follow immediately, there is not time to record the entire afterglow for the last lines of this half-field. Furthermore, there was no compensating exposure at the beginning of the film frame, as there was with a mechanical shutter, because there was no afterglow from the top half of the first field (with the beam off). Therefore with an electronic shutter it is necessary to introduce a "tilt" of phosphor excitation to make up for the deficiency. The required tilt varies with changes in the phosphor-decay characteristic. Because the exposure intensity and time relationships are not constant throughout the picture, the reciprocity-failure characteristic of the recording film must also play a part.

It must be remembered that in all of the foregoing analysis we have assumed a perfectly functioning system. Vibration of the optics, uneven action of the shutter, motion of film in the gate during exposure, unsteadiness of the raster on the recording tube, and so forth, can all disturb the ideal relationships. The greatest effect is to be expected at the splice, where exact superposition of two expo-

sure increments is required. Therefore, even if the intermittency effect is overcome, splice effects may remain. These are likely to be characterized by a certain randomness of appearance, as they are generally caused by random variations in the important factors.

It is true that the staircase test pattern is an extremely critical test for shutter-bar, and density effects which are clearly detectable by this means often escape notice in an average scene. On the other hand, in an actual scene with motion there is often a discontinuity in the geometry of the picture at the splice because there is a time lag of nearly $1/30$ sec between recording the area just below the splice and that just above the splice.

Although very excellent results can be obtained in conventional television recording with a film like Film C, using a mechanical shutter, it appears that to attain the very best quality some means of recording should be employed which would eliminate the splice from the picture area. The discontinuity in time which is associated with conversion from the television rate of 30 frames/sec to a lower film frame rate should be "hidden in the frame line" for every frame, not just for alternate frames as we do today. To accomplish this economically might require a frame rate different from 24 frames/sec for the recording portion of the system.

Acknowledgment

The author is pleased to acknowledge the many contributions which have been made by others in the Eastman Kodak Co., especially the members of the Film Emulsion Division, and Kenneth Lisk, who assisted very ably in all of the experimental recording and in evaluating the results.

References

1. F. N. Gillette, "The picture splice as a problem of video recording," *Jour. SMPE*, 53: 242-255, Sept. 1949.
2. F. N. Gillette and B. D. Plakun, "Shutter cycles for television film recording," *Jour. SMPTE*, 69: 587-592, Sept. 1960.
3. S. W. Athey, "The mechanics of TV recording," *Audio Eng.*, 34: V4-V8 (V14), May 1950.
4. J. H. Webb, "Relationship between reciprocity law failure and the intermittency effect in photographic exposure," *J. Opt. Soc. Am.*, 23: 157-169, May 1933.
5. J. H. Webb and C. H. Evans, "The failure of the photographic reciprocity law at low intensity," *J. Opt. Soc. Am.*, 28: 431-436, Nov. 1938.
6. P. C. Burton and W. F. Berg, "Study of latent-image formation by a double-exposure technique," *Phot. J.*, 86B: 2-24, Jan.-Feb. 1946.
7. W. F. Berg, A. Marriage and G. W. W. Stevens, "Latent-image distribution," *Phot. J.*, 81: 413-424, Sept. 1941; and *J. Opt. Soc. Am.*, 31: 385-394, May 1941.

A Microdensitometer for Photographic Research

By FRANK P. HERRNFELD

A microdensitometer has been designed and built along modest lines for photographic research. It has a resolving power of about 850 lines/mm when the scanning aperture is 1 micron wide and 40 microns long. The response is linear down to 0.1% transmission for the same aperture. By narrowing the aperture, the resolving power can be increased to 2000 lines/mm. Visual readings can be taken on a self-contained meter or a recording can be made on chart paper with rectangular coordinates.

FIGURE 1 is a general view of the instrument. For an optical system the microdensitometer has a modified Zeiss Standard GFL microscope with inclined binocular phototube. This allows visual monitoring during recording.

Optical Features

Figure 2 shows the optical system of the microdensitometer. The collector focuses the filament of the lamp into the aperture diaphragm of the condenser. A synchronous interrupter wheel is placed between the collector and condenser lens so as to make the unit adaptable to a-c amplification. The condenser lens in turn focuses the condenser aperture image of the filament at the exit pupil of the objective. The sample to be investigated is placed on the stage just above the condenser. The image of the sample is picked up by the objective and is broken into three separate paths by the deflecting prism. Two paths are used for binocular observation and the third is used for projecting the image onto the measuring slit.

In a semidarkened room the image of the sample appears plainly at the slit

plane and the final focusing is done at this point.

The slit is mounted in front of the collector prism. The exit face of this prism has a flash opal coating for even illumination of the entire cathode area of the photoelectric cell.

Electrical Features

Figure 3 is the electrical schematic of the amplifier. The photocell used is the RCA 929 with an S4 surface. The anode voltage of the photocell is held to below 18 v to prevent any ionization of occluded gasses. The first amplifier is a Type 5879 vacuum tube connected as triode. The voltages of this tube are adjusted to keep the grid current well below 10^{-9} amp. The wire-wound plate load resistor is also used as a continuously variable volume control. Its output feeds a step potentiometer having four steps of 20 db each, giving it an overall range of 80 db. This step potentiometer is followed by a 3-stage resistance-coupled, negative-feedback, stabilized amplifier. Twenty-four db of negative feedback is applied in the passband, assuring good linearity.

Included in the feedback path is a coil and condenser tuned to the frequency of the interrupter wheel. This gives the amplifier a frequency characteristic as shown in Fig. 4, increasing the usable

signal-to-noise ratio so that equivalent noise input resistance compares to 25 ohms. A slit illumination of $0.285 \mu\text{m}$ will give a signal still having a signal-to-noise ratio of 38 db.

The output of the amplifier either feeds the self-contained meter or may be fed into a strip chart recorder. The full scale output voltage is 3.5 v into a 1500-ohm load. The linearity at this voltage is better than 1%.

Mechanical Features

Scanning is accomplished by driving the sample past the objective of the microscope. The lead screw of the stage is driven by a shunt-wound d-c motor through a precision gear reducer.

The schematic of the gear reducer is shown in Fig. 5. The field coil of the motor is over-excited to give the motor high torque at low speeds. The speed of the motor is controlled over a ratio of 50:1 by the variable transformer feeding the armature through a rectifier. A direct drive results, i.e. motor is coupled directly to stage lead screw, if the electric clutch C is energized, coupling the output shaft to motor shaft directly. A 10:1 gear reduction is accomplished when electric clutch C_A is energized. The motor pinion P_1 drives gear G_1 which is solidly coupled to pinion P_2 which in turn drives gear cluster G_2 , P_{1A} which is fastened to the driver part of clutch C_A . A 100:1 gear reduction is accomplished by energizing clutch C_B and a 1000:1 by energizing clutch C_C . Thus by changing from one clutch to another and proper setting of the variable-speed control, the speed of scanning the sample may be varied by a ratio of 50,000:1.

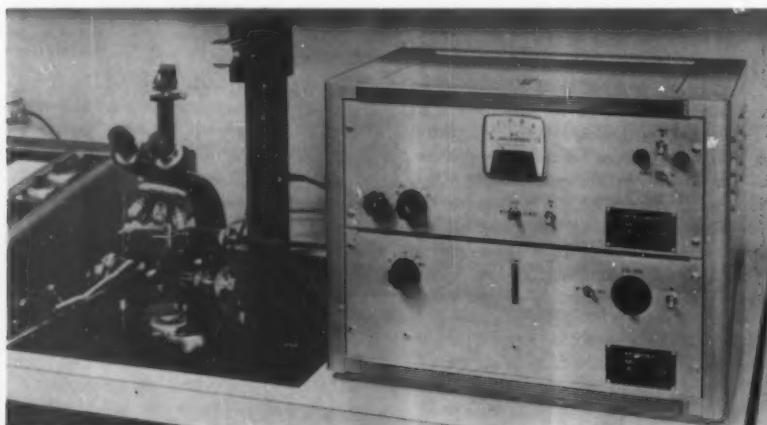


Fig. 1. General view of instrument in a typical installation.

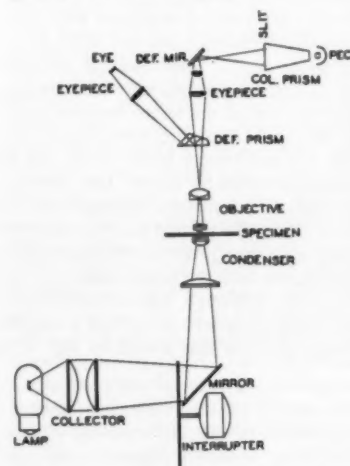


Figure 2.

The scale of the recording is determined by the sample under observation and by the information required. A 30-mm sample may be scanned in as little time as five seconds or may take as long as seven hours.

Performance

The instrument has been tested by tracking across a fine wire to produce a trace as shown in Fig. 6 up to five times in succession, and it was often impossible to tell the five superimposed traces apart.

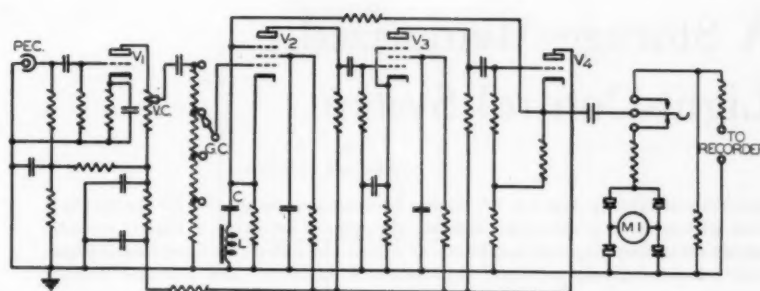


Figure 3

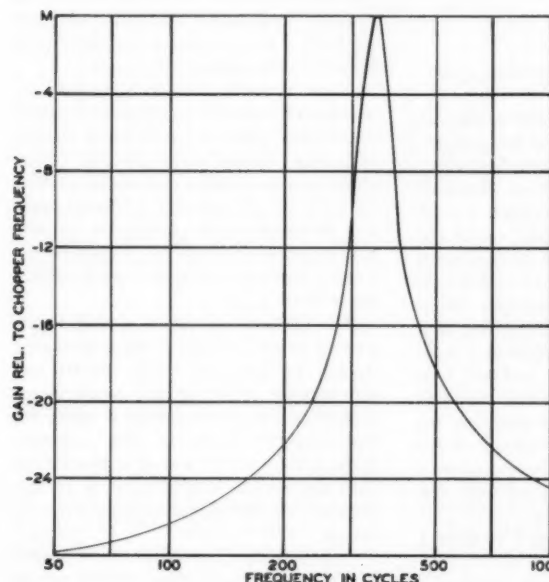


Figure 4

Density differences can be measured to within 0.5% over a density range between 0 and 3.0.

Discussion

Frank Sliker (Rochester Institute of Technology): Is this an instrument that a very modest research laboratory can afford?

Mr. Herrfeld: I can only say here that as microdensitometers go, it is inexpensive.

Mr. Sliker: I noticed that on the slide of the densitometer trace (Fig. 6), as we were going up the second plateau, there was a very steep rise and then a sharp decline again. Was this characteristic of the object that you were scanning or is this characteristic of the densitometer?

Mr. Herrfeld: I believe it is actually the characteristic of both the optics and of the densitometer.

Pierre Meritz (Consultant, Lido, Long Beach, N. Y.): Does the fact that you use a very sharp tuned circuit make the system unduly sensitive to slight changes in the chopping frequency?

Mr. Herrfeld: As mentioned in the paper, we are using a synchronous motor — and we went to very great pains to keep it at synchronous speed by enclosing the interrupter in a housing in order to reduce the wind resistance — so we won't get the unnecessary hunting of the wheel — slowing and speeding up the motor.

Dr. Meritz: Even then it seems like a very sharp tuned circuit — however, apparently you have solved the problem of controlling the speed. Another question is this: most densitometers have a double light path — one which is a con-

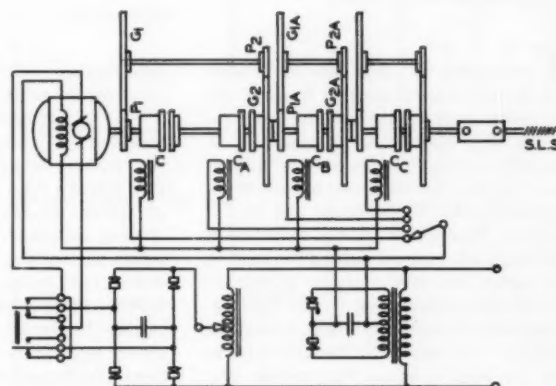


Figure 5

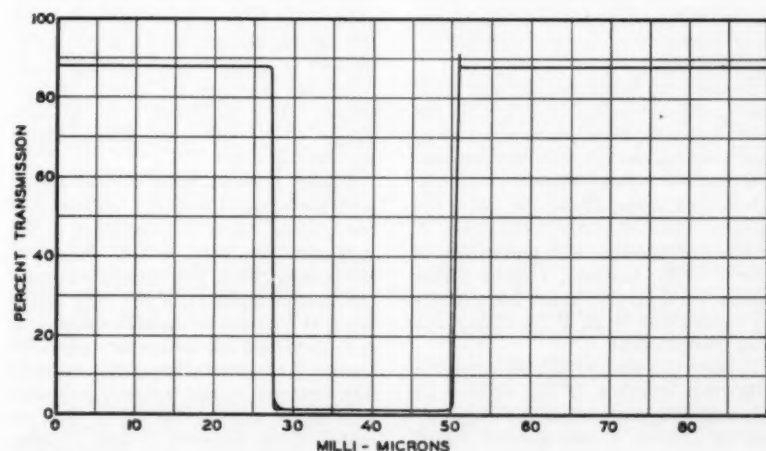


Figure 6

trol path and one which is a path through the sample, and you seem to do it with only one light path — which means that it may be unduly sensitive to changes in the light output of the lamp. As to calibration, is it correct that you calibrate with the sample out, and then put the sample in?

Mr. Herrfeld: That's correct. We have an electronic voltage regulating transformer in the unit. The lamp is electronically regulated, and we hold the current through the lamp

better than 1%. There is no problem here. The problem we had, actually, was the baffling, i.e., keeping stray light out. Another problem was the differential in sensitivity when scanning across the cathode of the photoelectric cell. We found out that we had to throw about 20 db of light away, utilizing only about 10% of the light, by having the end of the collecting prism coated with a flash opal deposit, thus spreading the light over the entire cathode area. This reduced the error to less than 1%.

A Storage Memorized Light-Control System

By JEAN DE BACKER

Operation of lighting stages or TV studios becomes too complicated for the operator even with present preselection systems. Equipment involving a control console; remote-controlled magnetic amplifiers, or silicon controlled rectifiers; intermediate triple electromagnetic memory; punched-card machine; and repeater normal typewriter is used to reproduce automatically all lighting "states" determined during rehearsals. The operator controls the transfer from one state to the next one by pushbutton action.

TECHNIQUES of stage lighting, evolving in line with the present trend of the art, bring increasingly difficult problems to lighting specialists, particularly in respect to methods of control and adjustment of the light intensity of individual circuits on the theater stage and in TV studios. This trend of the esthetics of lighting leads to a substantial increase in the operations that must be performed by electricians in charge of stage lighting. As a result these electricians request more facilities. The answer of the industry, so far, has been to adapt and modify, step by step, existing equipment. Through these adaptations, the equipment has reached a stage of high technical complexity linked with complicated operation, without enabling the electrician to meet the required performance.

How to record the lighting program, set forth by the producer and determined during rehearsals, is one of the unsolved problems. This recording should enable the electrician to reproduce during the show this lighting program with fidelity and accuracy.

In order to make the operator's job easier, various systems, among them the most important, or the most complicated, have been devised to enable the operator to prepare a certain number of effects. Efforts toward simplifying the job of the operator have led to the development of preselection systems. The possibilities of these systems, however, remain within narrow limits for the reason that extending preselection to all of the effects of a show is impractical.

Because this method did not present a satisfactory solution, it was decided to approach the problem in a different way and to attempt a new solution based upon a thorough study of the requirements of theater lighting. The first step was to disentangle a functional doctrine of the requirements of the lighting problem and then to establish the program of

performance which the control equipment should meet.

For our purposes, any lighting may be considered as being in one of two categories, namely lighting *state* and light *effect*. The lighting state is a static condition of all circuits during a determined period of time, no matter how short, which involves all lighting circuits in operation during that period with their individual lighting intensities. For example, when raising the curtain at the beginning of a scene, suppose that the lighting conditions correspond to state 1. State 1 is followed, beginning at a certain moment and extending for a certain duration, by state 2. The beginning and the end of this lighting state are chosen in accordance with practical criteria linked with the action, the text or the music.

Switching over from state 1 to state 2 should be achieved within a determined time and in accordance with conditions required by the action; this dynamic changeover is designated light *effect*. All the lighting conditions of a show can be defined as a sequence of lighting states connected together by means of light effects. There are three types of light effects: *transfer effect*, *discontinuous effect*; and *blackout effect*.

Figure 1 shows these various effects with the value of the light intensity I of the circuits shown in percentage of the maximum, vs. time. Graph (A) shows the transfer effect. This transfer occurs by continuous variation of the light intensities, at constant or variable speed from t_1 to t_2 . Graph (B) adds a new phenomenon to the transfer effect (note circuit 1). The decrease in light intensity is continuous down to a certain value, then remains steady between t' and t'' after which the light intensity of circuit 1 increases and reaches state 2. That is what we call discontinuous effect.

Graphs (C) and (D) show more discontinuous effects. Between t' and t'' circuit 1 reaches a new state but all of the circuits are not in that steady condition and circuits 2 and 3 undergo, during that same time, a continuous variation in intensity. So this operation should also be considered as an effect.

Graph (E) shows the blackout effect. All of the circuits vary continuously going through a zero value. Choosing another moment for the zero value brings us to Graph (F) and if the blackout lasts for a certain duration, and if it applies to all circuits a new state is created (Graph G). On the other hand, when the blackout is not simultaneous for the various circuits we have a series of discontinuous effects for which the value t' is zero.

These examples may serve to show the various effects and combinations which the control gear of the lighting circuits of a stage should make possible. These combinations of states and effects involve, for the operator, not only a difficult problem in handling the equipment but also a complicated recording process of the various lighting conditions required during a show.

The lighting equipment should be regarded as an instrument capable of producing lighting states (or effects) and also capable of storing in a memory various situations, this making it easier for the operator to record and duplicate these situations. It was also recognized that the system should meet a certain number of additional precise requirements.

In this context we will define "circuit" as all lines coming through the system and feeding either a single light source or a group of them. The number of circuits on a stage can vary greatly up to a total of about 200; and the first criterion is that each circuit should be adjustable separately with variation from zero to full light continuously reaching, during this operation, any desired value in both directions, either increase or decrease. Second, the operator should at first glance, at any moment, have an accurate notion of the situation of any of the circuits. The third criterion is based on time; the selection of circuits and their adjustment from one value to another should be effected at a definite time to conform with the action of the show.

Mechanical Solution of Storage in Memory

Functional shortcomings of all existing preselection systems led us to attempt the storing in memory all of lighting "stages" of a show. It was decided that the storage should be automatic. Hand operation of the control gear for storage or preselection of all of the lighting states would be too difficult for the operator; furthermore, such a system would not solve the problem of recording the individual light effects.

Presented on May 12, 1961, at the Society's Convention in Toronto by Austin G. Cooley for the author Jean De Backer, ADB Etablissements Adrien De Backer S.A., 275 Chaussee de Louvain, Zaventem, Belgium.
(This paper was received on April 10, 1961.)

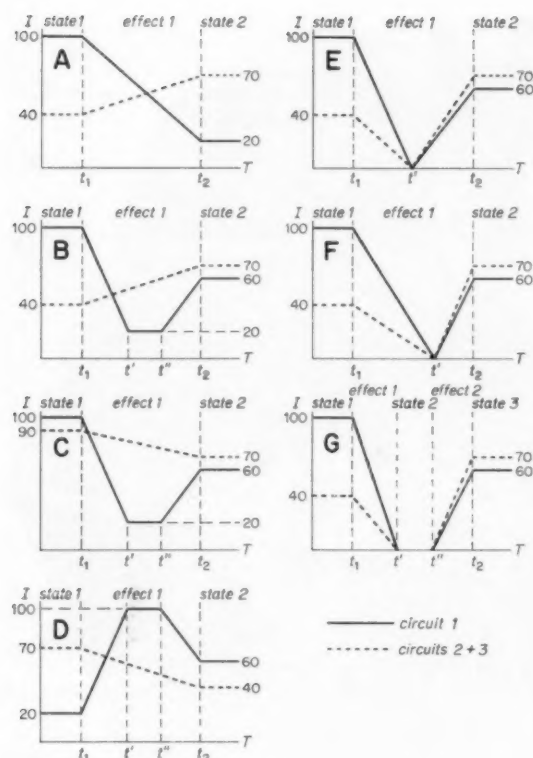


Fig. 1(A)-(G). Diagrams of light effects.

The idea of an automatic unrolling of all of lighting conditions of a show was rejected as impractical because of the possibility of unexpected incidents linked with human factors, occurring during any show. The rhythm of a production can vary substantially, depending on reactions of the audience and the cast. To solve these problems, separate systems were devised, one automatic and the other hand-operated. The automatic system records and reproduces states; and the hand-operated system controls effects. This system was planned to permit any correction or modification which might be required during a show, due to unforeseen occurrences. The ADB system here described, has been developed in accordance with the practical principles outlined below.

Basic Principles of the Equipment

If any lighting state has been automatically recorded and can be reproduced automatically by the equipment, any transfer or effect would be effected by hand or at least would be under permanent control of the operator. (Hand operation can be replaced by servo motors.) This system can, of course, apply only to remote-controlled equipment, by electromechanical or purely electrical methods, employing either magnetic amplifiers or silicon controlled rectifiers. Control of these can be achieved by means of a potentiometer in the pilot

circuit, the number of potentiometers being equal to the number of circuits in use.

The schematic principle of the ADB system encompasses a system for recording the position of the potentiometer contact and duplicating, when required, the light intensities in line with these positions. If, for example, for state 1 a potentiometer was set at 50, and if for state 2 its setting should be 80, these two settings having been previously recorded, the only operation required would be to transfer by hand from one position to the other in accordance with a predetermined speed and mode. It is thus sufficient to take due note of the moment, speed and mode of transfer required.

With a view to overcoming possible failure of any part of the system, emergency operation by hand should be possible.

Practical Requirements

These can be summarized as follows:

- (1) Each circuit should be controlled separately by hand, either for rehearsals or at any moment, for the correcting of any circuit.
- (2) Recording or storage in memory of a lighting state should be possible at any moment during rehearsal.
- (3) The operator should know for two or three states in advance the position of all the circuits involved.
- (4) It should be possible to cope with any special case encountered during any

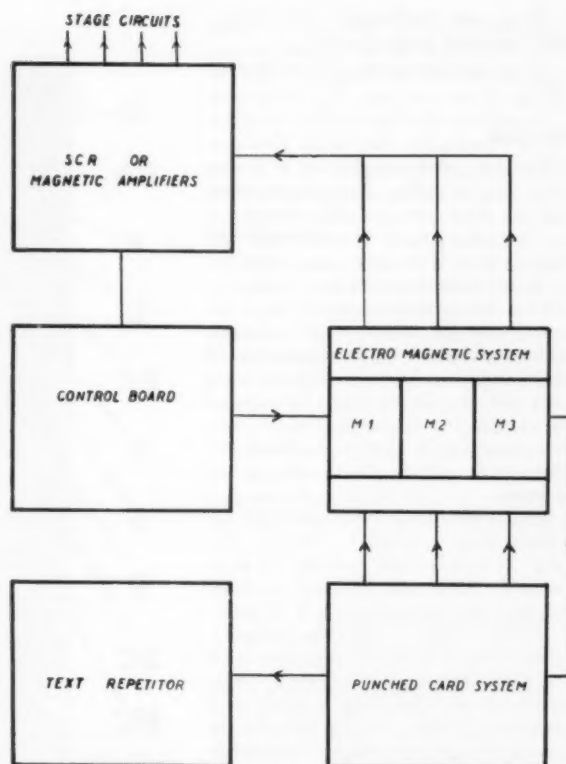


Fig. 2. Block diagram of the ADB Storage Light Control.

show: for example, it should be possible during a performance to repeat any state.

Solution

After comparing the characteristics of existing magnetic, electromagnetic or mechanic systems, and considering the economics of the systems, the punched-card system seemed the most promising. A punched-card system is currently being used for reliability and economy.

The main problem was that of developing a machine meeting exactly the special problem encountered on stages. To do this it was necessary to add to the punched-card system additional equipment because of the delay in using the information recorded on the punched card which, in many cases, could not match the rate of change of the lighting states. Therefore, the system was built with the special punched-card equipment linked to an intermediate electromagnetic memory system. Included in the system are the potentiometers, an electromagnetic memory, and a punched-card system.

Description of the Equipment

The system is thus made of five distinct elements as shown in Fig. 2.

- (1) the operation and control desk (control board),
- (2) the magnetic amplifiers rack (SCR or Magnetic Amplifiers),
- (3) the triple intermediate memory (electromagnetic system),

- (4) a card perforator and pickup (punched-card system), and
- (5) a repeater typewriter (text repe-
titor).

The Desk

The desk, shown in Fig. 3, is in two parts, one including the potentiometers and the other one grouping all controls for recording (and reproducing) the lighting states in the memories. There are as many potentiometers as circuits involved. The potentiometers are in three rows. Each potentiometer (*P*) is linked with a pushbutton (*C*) for the purpose of individual corrections, and a numeral pilot (*ID*) showing the light intensity of the circuit. The second part of the desk includes a certain number of general and centralized controls for the storage in memory.

The system design has provided for intermediate memories (M_1 - M_2 - M_3) (Fig. 2) with several controls for each memory. These are grouped in three vertical rows shown in Fig. 3. A safety pushbutton (*EP*) enables the recording in the memory under consideration of all the potentiometers in operation, while simultaneously punching a card. Two pilot lamps *P* and *p* indicate recording in process (*P*) and recording performed (*p*).

A safety pushbutton (*EA*) enables the transcribing from a card to the intermediate memory (reproduction of a lighting state). Two pilot lamps provide for reproduction in process (*A*) and reproduction performed (*a*).

The pushbutton (*EC*) is used to punch a card from a situation stored in the intermediate memory. It is used for general correction of a lighting state. Three pilot lamps (*C*), (*EC*) and (*c*), indicate, respectively, in process, performed, faulty condition during operation.

The *NC* system gives the punched card a serial number in order to trace any card whenever required. The digital pilot lamps (*SC*) show the serial number of the recorded or reproduced card.

The pushbutton (*R*) is used for control of reproduction, and two pilot lamps indicate whether in process or performed. The pushbutton (*S*) is used for the digital signaling of a memory.

The desk is also equipped with the following:

- (1) one master potentiometer (*G*) for progressive adjustment of all circuits (progressive blackout);
- (2) one transfer potentiometer (*T*) for progressive transfer from one state to another; one pushbutton (*OD*) for abrupt transfer;
- (3) one pushbutton (*RP*) to put out of action the memories and to restore hand operation of the circuits;
- (4) one pushbutton (*B*) for switching abruptly any state on or off;
- (5) one contact key for locking up the entire equipment;

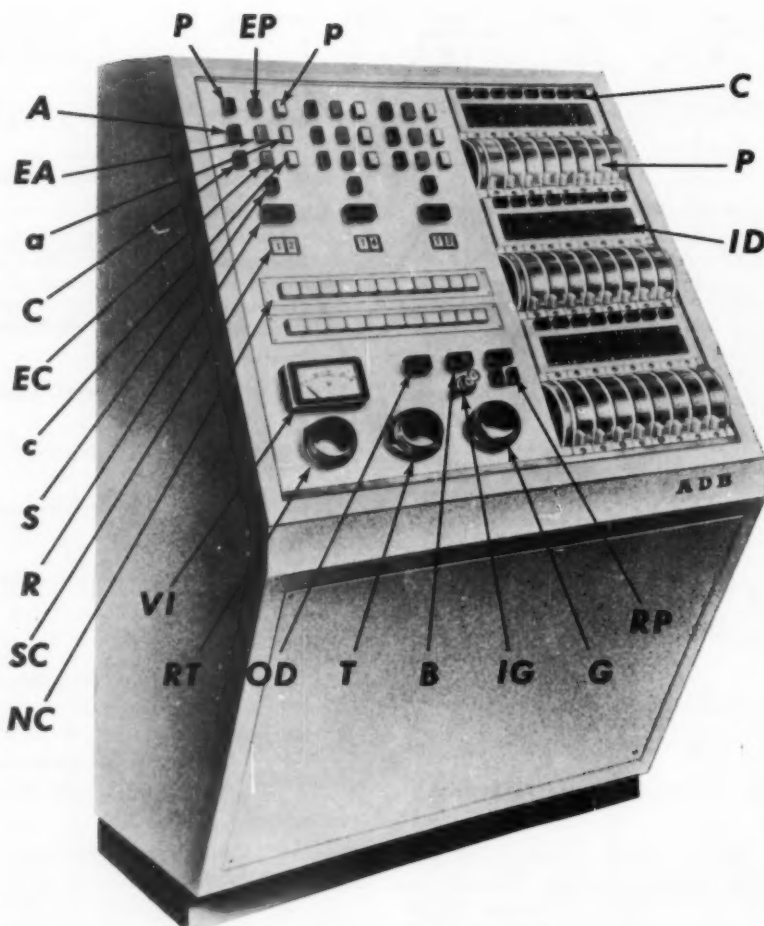


Fig. 3. The console; keyed diagram related to text description.

- (6) one voltmeter (*VI*) showing the voltage of the mains; and

- (7) one adjustment knob for the output tension of the circuits.

The Rack

The rack (Fig. 4) consists of magnetic amplifiers or equivalent equipment. This is a well-known item and we do not think it has to be described.

The Intermediate Memory

The intermediate triple memory is housed in an independent cabinet which can be situated at any distance from the control desk. The system is based on special relays and is fairly complicated. Due to the frequency of operation of these relays it is better to put the cabinet outside of the stage or studio area in order to reduce its noise level.

The Punched Card

The punched-card machine (Fig. 5) is of a classical type and has been modified in line with the requirements of the circuits and of the special operations to be performed. The machine works at its normal speed for punching and reproduc-



Fig. 4. The rack, including the transient memory equipment.



Fig. 5. The punched-card system with typewriter.

ing hence the reason for intermediate memories.

Punching Repeater

In order to make the operator's job easier and also in order to overcome any

difficulty which might crop up in case of trouble with the automatic system it is clearly an important requirement to obtain in clear language a duplicate of the lighting program. The repeater typewriter (Fig. 2) transcribes on a special

form the condition of each individual lighting state giving the serial number of the circuits and the value of the light intensity for each state, thus enabling the operator to intervene at any moment if required. This clear program can be used if it becomes necessary to go back to hand operation.

Conclusions

This system, built with fairly simple components, is no more expensive than other modern control equipment. In our opinion it anticipates future needs because it substantially reduces both the time required for rehearsals and the number of operators normally required. These two points are of considerable importance in terms of economy.

It is really good fun to keep in a pocket a bunch of cards which can duplicate at any later date the result of exhaustive rehearsals.

Discussion

K. Blair Benson (Columbia Broadcasting System): Can you tell us where this equipment is in use at the present time?

Mr. Cooley: My impression is that it has been built and is in the check-out stage.

Written reply by Mr. De Backer: "... it will be in use in December, 1961, at the Théâtre National de Belgique in Brussels."

Letter to the Editor: Infrared Transparency of Magnetic Tracks

In reference John A. Maurer's excellent paper on "Photographic Sound for 8mm Film" (*Jour. SMPTE*, 70: 618-624 Aug. 1961), I made a comment at the end of the published discussion to the effect that I was going to demonstrate on the next day a method for putting both optical and magnetic tracks on the same film.

I have received several inquiries from people asking what I was referring to and whether the demonstration actually took place, since it was not published as a paper. By way of explanation I would like to point out that the demonstration did take place — with 16mm film — but I did not think a formal paper was justified, since I had presented two papers on the subject in 1957, and these were published in the September and December issues of the *Journal* for that year under the title "The Infrared Transparency of Magnetic Tracks."

Briefly, these articles describe how, by utilizing the infrared sensitivity of the lead-sulfide photocell, it is possible to cover an optical soundtrack completely with a magnetic stripe and then reproduce both soundtracks independently and simultaneously for bilingual and stereophonic purposes.

The reasons for putting on a new demonstration at Toronto were to show that:

(a) The new germanium photodiode which has been introduced as a superior substitute for the lead-sulfide cell in many projectors was equally effective for the infrared transparency of magnetic tracks.

(b) The new Eastman magnetic stripe could be used just as effectively as the Reeves stripe and the Minnesota Mining laminate which were previously used.

(c) The occasion was also taken to demonstrate a wide variety of stereophonic recordings and the effectiveness of all-transistor power amplifiers.

In view of Mr. Maurer's article which mentions the possibility of providing stereophonic sound for 8mm pictures by changing the perforation standard, I would like to point out that with my method it should be possible to obtain stereophonic or bilingual sound even if the proposed change is not adopted. Moreover, my method inherently provides complete freedom from crosstalk between channels, which would be impossible with two magnetic tracks, and difficult with two optical tracks in such limited space.

On the other hand, I do agree with Mr. Maurer that his proposed change of standard would be very desirable for either magnetic or optical sound — as well as a combination of both.

September 1, 1961

GEORGE LEWIN
U.S. Army Pictorial Center
35-11 35th Ave.,
Long Island City 1, N.Y.

standards and recommended practices

Proposed American Standards

The proposals published here have been approved by the engineering and Standards Committees and are submitted for a three-month trial period:

PH22.132, 16mm 400-Cycle Signal Level Test Film, Magnetic Type, 1R-3000

PH22.133, Screen Luminance and Viewing Conditions for 35mm Review Rooms

Proposed American Standard PH22.132 is the result of an ad hoc committee study coordinated by Ellis W. D'Arcy of the Society's Sound Committee. It is intended that the specifications describe the test film presently offered by the Society as M16SL as accurately as possible.

Initiated by the Screen Brightness Committee, PH22.133 is a step toward providing a logical small group of screen brightness standards and an attempt to suggest how the variations in practice found in the industry can be reduced.

All comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to February 15, 1962. If no adverse comments are received prior to that date, the

proposals will be submitted to ASA Sectional Committee PH22 for further processing.—A. E. Alden, Staff Engineer

Approved American Standards

The two new American Standards approved by the American Standards Association on November 10, 1961 are published here for your information.

The revision of PH22.2-1961, 35mm Photographic Sound Motion-Picture Film Usage in Camera, is substantially a re-affirmation of the 1954 issue, differing only in the relationship between photographic sound and picture. The 1954 issue specified this at 20 frames $\pm 1 \frac{1}{2}$ frame, the new standard indicates the distance may vary and only the positive print must be in accordance with American Standard Photographic Sound Record on 35mm Prints, PH22.40.

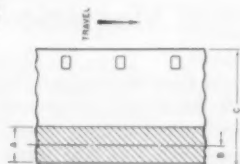
PH22.126-1961, 16mm Multi-Azimuth Test Film, Magnetic Type, is a new standard. The Society's Sound Committee recognized the need for a film which could be used for determining the azimuth adjustment of a magnetic reproduce head without disturbing its adjustment.—A.E.A.

Proposed American Standard

16mm 400-Cycle Signal Level Test Film, Magnetic Type, Perforated IR-3000

PH22.132

Page 1 of 2 Pages



Dimension	Inches	Millimeters
A	0.200 ± 0.002	5.08 ± 0.05
B	0.103 ± 0.002	2.62 ± 0.05
C	0.630	16

1. Scope

This standard specifies a 400-cycle signal level magnetic test film for use in controlling magnetic sound recording levels and standardizing methods of signal-to-noise measurements on 16mm magnetic sound systems.

2. Test Film

2.1 Dimensions of Sound Record. The location and dimensions of an originally recorded sound record shall be in accordance with American Standard 200-Mil Magnetic Sound Record on 16mm Film Base Perforated One Edge, PH22.97-1956.

2.2 Test Frequencies. The recorded frequency shall be 400 ± 4 cycles per second.

2.3 Mean Film Speed. The recording and reproducing film speed shall be at a mean film rate of 24 perforations per second with a tolerance of ± 1 percent, or approximately 36 ft per minute.

2.4 Distortion. The total harmonic distortion of the recorded frequency shall not exceed 1 percent.

2.5 Permissible Flutter. The total flutter shall be less than ± 0.07 percent, as measured in accordance with American Standard Method for Determining Flutter Content of Sound Recorders and Reproducers, Z57.1-1954.

2.6 Recorded Signal Level. The magnetic record shall have a recorded intensity of 10 ± 0.5 gauss which is to be determined by the method of calibration specified in 3.1.

2.7 Film Stock. The film stock used for the test film shall be cut and perforated in accordance with American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953.

2.8 Film Identification. Each test film shall be provided with a suitable leader, title, and trailer, and shall be accompanied by a calibration of the level of the frequency recordings.

3. Calibration

3.1 The film shall be calibrated in accordance with the inductive loop method as described in the following reference:

Robert Schwartz, "Absolute measurement of signal strength on magnetic recordings: phase II," *Jour. SMPTE*, 66: 119-122, Mar. 1957.

NOT APPROVED

<div> <div> <div>Page 2 of 2 Pages</div> <div>PH22.132</div> </div> <div> <div>Proposed American Standard</div> <div>Screen Luminance and Viewing Conditions for 35mm Review Rooms</div> </div> </div>	<div> <div>Page 2 of 2 Pages</div> <div>PH22.133</div> </div>
--	---

national Commission on Illumination in 1931. The acceptance angle of the photometer shall be as small as is practical, and shall

be so used that it accepts light from a screen area no larger than a circle whose diameter is 10 percent of the screen width.

APPENDIX

(This Appendix is used as a part of Proposed American Standard Screen Luminance and Viewing Conditions for 35mm Theater Rooms, PH22.133, but is intended to facilitate its use.)

A1. Review Rooms

During the preparation of motion pictures the producer, the motion-picture film laboratory personnel, and others examine the film many times from the original test shot through many stages to the final release prints. The films are projected in a specialized theater known as a "review room." These installations are designed to permit judgments of projected picture quality and determination of the suitability and acceptability of release prints, daily and work prints, production tests, printer and processing tests, etc. The rooms are constructed to accommodate a small reviewing group of usually 10-20 people. The actual picture size may be small or large depending upon the space available, but the viewing conditions are chosen to duplicate as nearly as possible actual theater viewing from the most desirable seating locations. All of the viewing conditions are capable of precise control and it is generally practical in review rooms to hold these variables to a minimum tolerance.

A2. "Normal Print"

To provide interchangeability in motion-picture projection, it is desirable that print quality conform to that of a "normal print" so that theaters can be set to operate at known projection conditions, and will thereby be able to exhibit projected pictures of good pictorial quality. It has not been possible to specify this "normal print" in terms of its optical density and other objective measurements because of the difficulties of specifying artistic quality in scientific terms. Accordingly, the "normal print" is defined as that print which conveys the desired artistic impression when projected under review room conditions as described by this standard.

A3. Theatrical Projection

Standards for theater screen luminance, such as American Standard Screen Brightness for 35mm Motion Pictures, PH22.39:1953, and others under study are intended to reproduce for the theater audience the same artistic impression given in the review room. It is anticipated that there shall be only one review room condition, but that there may be several theater room conditions—providing identical pictorial impressions under such widely different viewing conditions as exist in indoor theaters, drive-in theaters, auditoriums, etc.

A4. Drive-In Theater Projection

In the case of drive-in theater application, it is recognized that lighter prints are desirable.

A5. Meter Acceptance Angle

The maximum permissible acceptance angle of the luminance photometer will depend upon the instrument design and method of use, the size of the screen, and other factors. The acceptance angle of a suitable instrument must be such that a reduction in this angle (followed by necessary recalibration) does not change the magnitude of any reading specified in Section 2 by more than ± 5 per cent. The limiting conditions for the reliable use of such meters should be included in the manufacturer's specifications.

A6. Stray Light

Stray light, as defined in 2.2, includes non-image-forming light, such as lens flare, reflected projection light, ambient light, etc. Since the factors responsible for such stray light do not change unexpectedly, it will usually be sufficient to make stray light measurements at intervals. The two measurement procedures recommended for securing the proper screen image are as follows: (1) prepare a test film with an average light transmission of 10 percent, having in the center of each frame a black, circular test object of density 3.0 or greater, or (2) mount in the projector on opaque heat-resisting disk as a test object, locating it at the center of the aperture, between the aperture plane and the projection lens and within $1/16$ in. or less of the film plane; simultaneously project a film which has been printed to give a uniform transmission of 10 percent.

A7. Conversion of Units

Screen luminance in the U.S. is customarily measured in foot-lamberts, although in international usage, the nit is the preferred unit. One nit = 0.2919 foot-lamberts, 1 foot-lambert = 3.426 nits.

A8. Image Luminance

Note that this standard specifies screen luminance with the projector operating and no film in the aperture. When films are projected, the average image luminance will be considerably below this level, and will approximate the conditions of 2.2 for measurement of stray light.

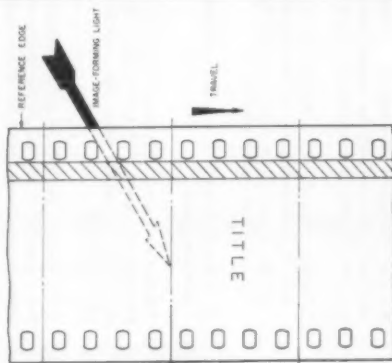
American Standard

35mm Photographic Sound Motion-Picture Film, Usage in Camera



Am. S. S. Std. of
PH22.2-1961
Revision of
PH22.1-1954

*CINC 775-134-45



1. Scope

This standard specifies the location of the photographic emulsion, the rate of exposure, and the relationship between photographic sound and picture of 35mm sound motion-picture film in single system cameras.

2. Position of Emulsion

Except for special processes, the emulsion shall be toward the camera lens as shown in the diagram.

3. Rate of Exposure

The rate of exposure shall be 24 frames per second.

4. Relationship Between Photographic Sound and Picture

The separation of the picture and corresponding photographic sound as recorded in the camera is dependent upon the camera design and varies widely among camera models. When prints are made, the picture-sound separation shall be in accordance with American Standard Photographic Sound Record on 35mm Prints, PH22.40-1957. The location and dimensions of the photographic sound record shall also be in accordance with PH22.40-1957.

5. Revision of American Standard Referred to in This Document

When the following American Standard referred to in this document is superseded by a revision approved by the American Standards Association, Incorporated, the revision shall apply:

American Standard Photographic Sound Record on 35mm Prints, PH22.40-1957

Drawing shows film as seen from inside the camera looking toward the camera lens.

Approved November 10, 1961, by the American Standards Association, Incorporated
Sponsor: Society of Motion Picture and Television Engineers

* Universal Decimal Classification

Copyright 1961 by the American Standards Association, Incorporated
10 East 40th Street, New York 16, N.Y.

Printed in U.S.A.
AMAS/AM16/40

PH22.133 NOT APPROVED

16mm Multi-Azimuth Test Film, Magnetic Type

1. Scope

This standard specifies a test film to be used for determining the azimuth alignment of a magnetic reproducer head without disturbing its adjustment.

2. Test Film

2.1 The test film shall have an original sound record having a wave shape that is approximately sinusoidal. The frequency of the sound record shall be approximately 7000 cps when the film travel rate is 24 perforations per second (approximately 36 ft per minute).

2.2 The recording shall be made at 100-percent modulation level with a tolerance of ± 0 -2 db. 100-percent modulation is defined as the recording head current at which 3 percent total harmonic distortion occurs at a signal frequency of 1000 cps.

2.3 The location and dimensions of the sound record shall be as given in the diagram and in Table 1.

2.4 The sound record shall be recorded in such a manner as to produce sequential steps recorded at calibrated deviations from the perpendicular to the direction of film travel.

2.5 This test film shall have a total of 11 steps, which, when reproduced on a properly aligned reproducer, will give output indications varying from minimum at the first step to maximum at the sixth step and back to minimum at the 11th step. The sixth step shall be a recording whose azimuth is perpendicular to the direction of film travel within ± 1 minute of arc. The azimuth of all other steps shall be within ± 0.5 db of specified deviation for each step, as shown in the diagram and Table 1, excepting those of infinite loss.

2.6 The deviation in azimuth for the various steps shall be as shown in the diagram and in Table 2.

Approved November 10, 1961, by the American Standards Association, Incorporated

Sponsor: Society of Motion Picture and Television Engineers

Copyright © 1961 by the American Standards Association, Incorporated
10 East 40th Street, New York 18, N.Y.

Universal Document Classification

Approved in U.S.A.
ANSI Z39.18-61

Page 1 of 2 Pages

Table 1. Computed Signal Outputs in Decibels Relative to the Output of Step 6, For Three Widths of Playback Heads.

Step No.	Footage*	Azimuth	Reproduce Head Width		
			0.200"	0.085"	0.050"
1	0.0	40°	†db	-28.0db	-5.0db
2	2.5	20°	∞	-3.5	-1.2
3	5.0	10°	-5.0	-0.9	-0.3
4	7.5	5°	-1.0	-0.2	-0.07
5	10.0	2.5°	-0.3	-0.05	-0.02
6	12.5	0°	0	0	0
7	21.0	2.5°	-0.3	-0.05	-0.02
8	23.5	5°	-1.0	-0.2	-0.07
9	26.0	10°	-5.0	-0.9	-0.3
10	28.5	20°	∞	-3.5	-1.2
11	31.0	40°	†	-28.0	-5.0

* Footage measured from the start of Step No. 1 to the start of the step indicated.

† Disregard measured values for these steps since the readings are influenced by secondary maxima.

The computed, theoretical signal outputs in Table 1 are relative to the output of Step 6, calculated from the relationship

$$\text{Output (db)} = 20 \log_{10} \frac{\sin \frac{W\theta}{\lambda}}{\frac{W\theta}{\lambda}}$$

where λ = Wavelength

θ = Angle of Misalignment (Radians)

W = Head Width (Reproducer)

Table 2

Step	1	2	3	4	5	6	7	8	9	10	11
minutes of arc from perpendicular	40	20	10	5	2.5	0	2.5	5	10	20	40

Step No.

AZIMUTH (MIN OF ARC)

11 - 40°

10 - 20°

9 - 10°

8 - 5°

7 - 2.5°

6 - 0°

5 - 2.5°

4 - 5°

3 - 10°

2 - 20°

1 - 40°

0.005"

0.500"

DIRECTION OF FILM TRAVEL

COATED SIDE UP

3. Film Stock

3.1 The film stock used shall be of safety type, cut and perforated in accordance with American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953 (note Section 6, below).

3.2 The dimensions of the magnetic coating are not specified herein but should be sufficiently wide to permit the placement of a sound record in accordance with this standard.

4. Film Length

4.1 This test film shall have a 6-foot head and tail leader.

4.2 Azimuth Step 6 shall be 8 feet in length and all others of 2-foot length, with no-signal spaces of 6-inch length between adjacent steps.

4.3 The total length of this test film, including leaders, sound record and signal breaks, shall be 4.5 feet.

5. Identification

Each test film shall have suitable identification markings.

6. Revision of American Standard Referred to in This Document

When the following American Standard referred to in this document is superseded by a revision approved by the American Standards Association, Incorporated, the revision shall apply:

American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953

APPENDIX

(This Appendix is not a part of American Standard 16mm Multi-Azimuth Test Film, Magnetic Type, PH22.126-1961, but is included to facilitate its use.)

This test film is designed to indicate whether the azimuth of a reproducer head has been set accurately, by the measurement of relative outputs from a test film of known geometry and accuracy. Step 6 on this film

has been made with true azimuth and it therefore becomes the prime reference with all other steps considered relative to it. A practical maximum error in the azimuth of the recording at Step 6 has been defined in 2.5 as $0^\circ \pm 1'$; this specification therefore controls the manufacturing excellence of the test film and establishes one limit on the precision of measurements with it.

Since the user of the film will measure the relative output of the various steps in decibels deviation from Step 6, the precision of the azimuth settings for these steps is defined in 2.5 as ± 0.5 db from the relative output levels of Table 1. This figure is, therefore, a practical measure of significant variations. The manufacturer of the test film will set up his equipment in accordance with Table 2, but will determine that the film meets the performance specifications of Table 1 and 2.5.

news and reports

91st Convention and Equipment Exhibit

April 29 to May 4, 1962 — Ambassador Hotel, Los Angeles

Theme: Advances in Color Motion Pictures and Color Television

Work on the Spring Convention is now well under way. The Program Chairman, *Edward P. Ancona, Jr.*, 3170 Lake Hollywood Drive, Hollywood 28, reports that Topic Chairmen have met to discuss solicitation of papers and already several have reported commitments of papers for their sessions.

The convention theme is not represented by a single topic on color alone; it is expected that the wide use of color in all phases of the motion-picture and television industries will be reflected in papers dealing with color in every topic area. In fact, several of the first papers sought concerned new color materials and a new color process.

One feature of the program will be the session on Projection Practices, in which it is planned to present a set of tutorial papers outlining good projection practices. Work on this session was started early and the results should be of great value to projectionists and those who administer projection-room operations.

Potential contributors to the 91st Convention Program are reminded that the closing date for the submission of abstracts to

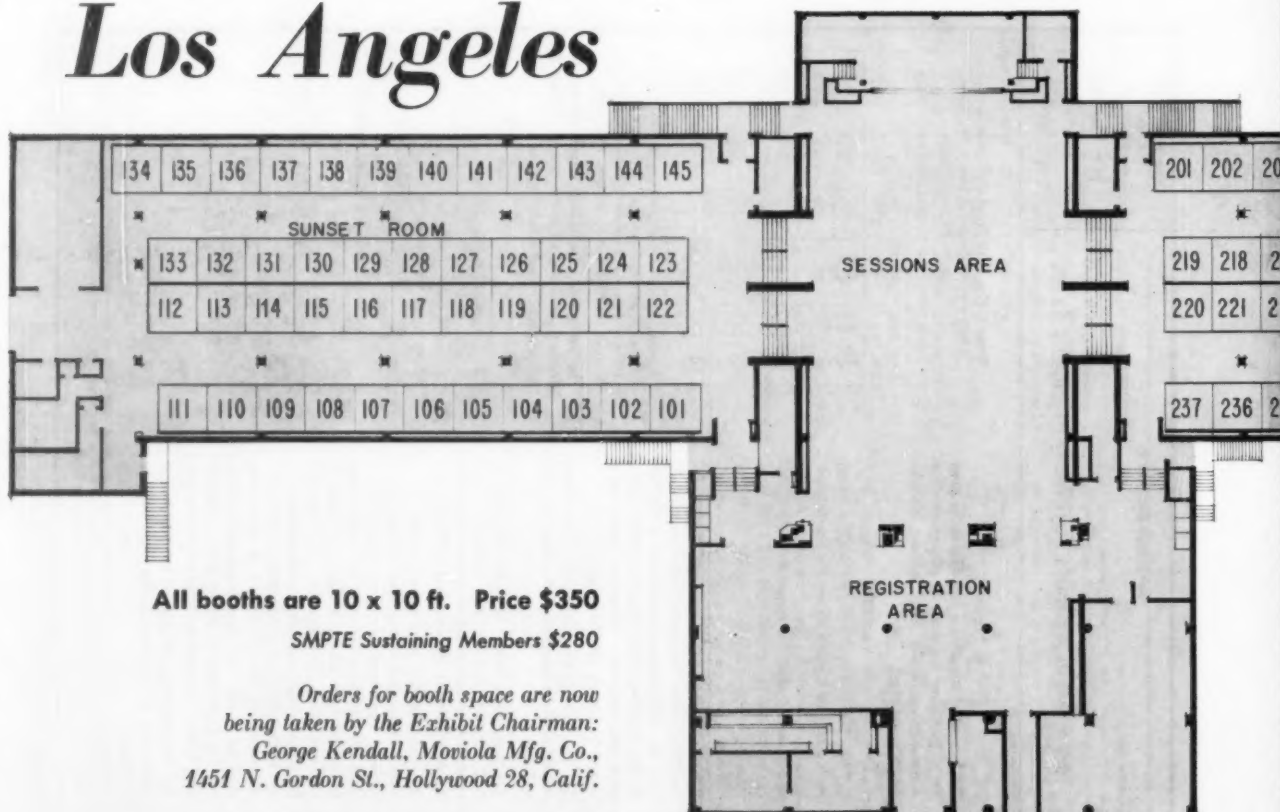
the Program Chairman and the Topic Chairmen is February 12, 1962. See the roster in the October *Journal*, page 834 or write Program Chairman Ancona, address above, or to Society Headquarters.

Equipment Exhibit

A brochure with full details about the Exhibit and forms for ordering space was recently mailed out to prospects. Anyone interested in having one of these may obtain it either from SMPTE Headquarters or from the Exhibit Chairman, *George Kendall*, c/o Moviola Mfg. Co., 1451 N. Gordon St., Hollywood 28.

So many exhibitors had to be turned away from the last Los Angeles Convention for lack of space that arrangements have been made with the Ambassador for twice the amount of room this time. Even so, we would urge anyone who has thoughts of showing equipment next Spring to get in touch with the Exhibit Chairman without delay.

Los Angeles



6th International Congress on High-Speed Photography

The Hague, The Netherlands — September 17–22, 1962

More details have been received from Dr. J. G. A. de Graaf, Chairman of the 6th Congress, and it is understood that a folder in the four official languages of the Congress — English, French, German and Russian — will shortly be ready for distribution. Meanwhile, here is the outline of the program as far as is presently known.

Time and Place: The 6th Congress will be held, under the patronage of H.R.H. the Prince of the Netherlands, September 17–22, 1962, at the Kurhaus Hotel, Scheveningen. Scheveningen is a seaside resort situated just outside The Hague.

Session Topics: Control systems, electric and electronic shutters, flash x-ray, high-intensity light sources, intensification techniques, materials for high-speed photography, short-duration light sources, types of cameras, ballistics and guided missiles, combustion studies, flow dynamics, medical and biological applications, micro studies, miscellaneous applications in industry, spectra studies, special techniques, values and problems in high-speed photography. A simultaneous interpreta-

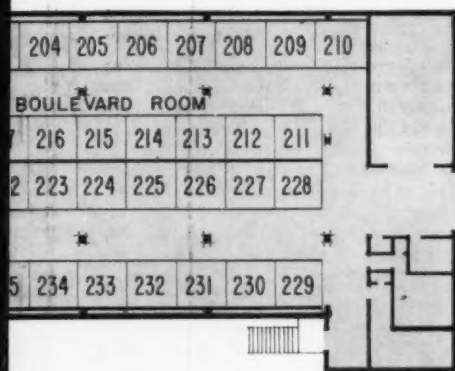
tion system in the four Congress languages will be available at all sessions.

Equipment Exhibit: There will be a scientific and a commercial exhibit. Participants in the Congress may exhibit their photographs and cameras free of charge in the scientific exhibit. Information about the commercial exhibit may be obtained from the Secretariat.

Registration: Registration for the week, not including excursions and farewell party, will be 75 guilders. Ladies registration fee will be 35 guilders.

Secretariat: Details about the cost of various types of hotel facilities, some description of the tours and excursions that will be available during the Congress, and provisional application forms, may be obtained from the Secretariat of the 6th International Congress on High-Speed Photography, 14 Burgemeester de Monchyplein, The Hague, The Netherlands.

Convention Exhibit



see the ONLY show of professional equipment from ALL parts or the motion-picture and television industries. Come to the Ambassador for the latest in TV BROADCAST & STUDIO EQUIPMENT • CLOSED-CIRCUIT • MOTION-PICTURE CAMERAS • PROJECTORS • INSTRUMENTATION AND HIGH-SPEED PHOTOGRAPHY • LIGHTING • PROCESSORS • PRINTERS • EDITING & LAB TEST EQUIPMENT • OPTICS

EXHIBIT OPEN APRIL 30 through MAY 3

91st SMPTE Semiannual Convention

AMBASSADOR HOTEL, LOS ANGELES

Education, Industry News

AIEE and IRE

A proposal to consolidate the American Institute of Electrical Engineers and the Institute of Radio Engineers is being studied by an eight-member committee appointed in accordance with the terms of a resolution approved by the Boards of Directors of both societies. The committee is directed to study the "feasibility, practicability and form" of the proposed consolidation. It is also authorized to present for approval a constitution and bylaws prepared "in consultation with representatives" of both societies. The committee is to submit a report to both societies by February 15,

1962, and if the report contains a recommendation for consolidation the consolidation plan would go into effect January 1, 1963, if voted upon favorably by the members of each society.

The resolution states in part "... the advancement of the theory and practice of electrical and radio engineering and the educational and scientific objectives of both Institutes may be better served by merger or consolidation... into one organization in which all present members would be included and in which they would enjoy the same rights and privileges now conferred on them by their separate organizations." The resolution further stated that the Boards of Directors deem it advisable in accordance with the stated

objectives of each society "... to move actively toward consolidation of activities and organizations... provided legal and operational problems incident to such consolidation can be satisfactorily solved."

Members of the committee are (IRE) Lloyd V. Berkner, President; Patrick E. Haggerty, President Elect; Ronald L. McFarlan, Past President; and Haradan Pratt, Secretary and Past President; and (AIEE) Warren H. Chase, President; Clarence H. Linder, Past President; Elgin B. Robertson, Past President; and B. Richard Teare, Jr., Director.

AIEE was organized in 1884 and has approximately 70,000 members from the United States and Canada. IRE, organized in 1912, is an international organization and has a membership of 91,000. About 6000 members now belong to both societies.

NEW! WF-30 FASTAX

16mm High Speed
Motion Picture Camera

NEW
PICTURE
QUALITY
Superb
Resolution
Color or
Black & White

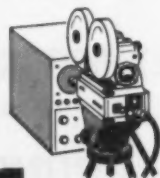
NEW
CAPACITY
1200'
Magazine

NEW
VERSATILITY
Variable
Speed Range
Flat
Speed Curve

Years Ahead in Design and Performance

A high speed camera with large film capacity... with a variety of speed ranges and high resolution has long been wanted by industry, the military and the government. The FASTAX WF-30 fills all these requirements and more. Darkroom loaded, "T" core, the magazine holds sufficient film for most studies. Camera versatility is another key feature. Variable speed range, controlled by a solid state loop servo device... rapid acceleration with flat speed curve within $\pm 4\%$ selected rate... start-stop capabilities. Superb resolution over entire frame results from excellent lens system and a sector shutter between rotating prism and focal plane.

WRITE for complete information and prices on WF-30
... the newest FASTAX in the wide line of Wollensak
high speed motion picture cameras.



WF-30
OSCILLOGRAPHIC
RECORDER

Wollensak 3M
AN AFFILIATE OF 3M COMPANY

850 Hudson Ave. • Rochester 21, N.Y.

MINNESOTA MINING AND MANUFACTURING COMPANY

Linwood Dunn, ASC, and his special effects film laboratory, Film Effects of Hollywood, 1153 N. Highland Ave., Hollywood 38, have recently completed an 18-month assignment for Producer-Director Robert Wise on the 65mm Mirisch Pictures production of *West Side Story*. Lin Dunn, Fellow of SMPTE, and for 28 years Director of Photography and head of the Special Effects Department at RKO Radio Pictures, reproduced on 65mm film some of the fascinating color effects previously found only in modern still photo techniques. These effects included color derivations created by manipulation of certain combinations of contrast and chromatic distortion variations through the use of special photographic and processing methods.

The Theme of the 92d Convention, October 21-26, Chicago, will be: *Communications Progress: Television and Motion Pictures in Industry and Education.*

Jack Behrend, Behrend Cine Corp., 161 E. Grand Ave., Chicago, has been appointed 92d Convention Program Chairman. There will be an Equipment Exhibit.

Boyce Nemec is the newly elected President of Reevesound Co., Subsidiary of Reeves Soundcraft Corp., 35-54 36th St., Long Island City, N.Y., where he has served as Executive Vice-President since 1958. He was SMPTE's Executive Secretary from 1947 to 1956. Announcement of Mr. Nemec's election to Reevesound presidency was made by Hazard E. Reeves, Chairman of the Board.

Lloyd E. Varden has been awarded the Progress Medal of the Photographic Society of America for outstanding accomplishments as educator, historian, author and scientist in photographic fields. This award is the highest bestowed by the PSA.

Internationally known for his accomplishments, especially for his work in the design and development of automated printing and processing equipment for large-scale photofinishing, Mr. Varden also holds a number of patents for electronic devices designed to determine exposure and color balance correction factors in color negatives and color positive printing. He is a member of the faculty of Columbia University's School of Engineering and it is largely due to his efforts that photography has been established as a

in the east...it's
MOVIELAB

for

color

and

black
&
white

MOVIELAB

MOVIELAB FILM LABORATORIES
MOVIELAB BUILDING, 619 W. 54th ST.
NEW YORK 19, N. Y. JUDSON 6-0360

*developing color negatives • additive color printing • reduction printing including A & B • color slide film processing • blowups • internegatives • Kodachrome scene-to-scene color balanced printing • Ektachrome developing and printing • registration printing • **plus complete black and white facilities including cutting rooms, storage rooms and the finest screening facilities in the east.**

major subject. He has published widely in national and international scientific journals, including the *Journal of the SMPTE*.

Ralph W. Wight has been named Vice-President of the Westrex Recording Equipment Division of Litton Systems, Inc. He will continue to serve as General Manager of the Division. His career with Westrex and the former parent firm, Western Electric, began in 1929. In 1936 he began his service with the recording facility of Westrex, where he participated in the development of sound-recording equipment for motion-picture and phonograph recording industries. Eleven Academy Awards have been presented to the firm for various equip-

ments it has developed and manufactured. Since 1958 when the firm was acquired by Litton, its field of endeavor has been expanded to include instrumentation data recording and commercial sound equipment.

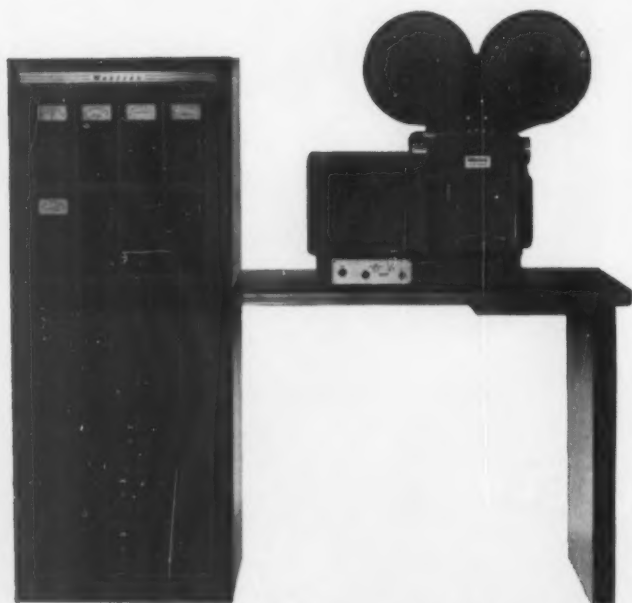
Daniel R. P. Eastman, former Research Assistant to D. H. Rank, Research Professor of Physics, Pennsylvania State University, has accepted the post of Manager of the new Specialties Department created by Plummer and Kershaw, East Greenville, Pa., manufacturers of precision optics. The new department will engage in developmental work in infrared materials and aspheric surfaces and will make prototype optics.

**every
Westrex
recording
system
is professionally
designed for
professionals**

The New Westrex 900 Recording Systems

are constructed for 35mm and 16mm photographic and magnetic, standard or push-pull, area or density negative, as well as direct-positive area sound track recording. Westrex research has resulted in world-wide leadership in sound recording, of which the Series 900 Systems are examples. They are designed for fixed installations or for easy mobility. Mobile installations can be mounted in a light truck or on a studio dolly.

Before replacing your present equipment, investigate the amazing versatility of a Westrex Series 900. Call today for complete specifications, or write Westrex Recording Division, 335 N. Maple Dr., Beverly Hills, Calif.



Westrex Company

A DIVISION OF LITTON SYSTEMS, INC. 

New titles for three members of the administrative staff of General Film Laboratories of Hollywood have been announced by William E. Gephart, Jr. Robert G. Goodwin, formerly Vice-President of Business Affairs is now Executive Vice-President; John Aitkens, former Controller, is Administrative Vice-President; and Stanley Judell who has been Assistant Controller is now Controller.

Acquisition of a 49% ownership of Japan Cine Equipment Mfg. Co., wholly owned subsidiary of J. Osawa & Co., Ltd., Tokyo, has been announced by Bell & Howell. Plans for the Japanese firm include the production of motion-picture cameras and projectors for sale in Japan and other world markets. It is not planned to produce Bell & Howell brand cameras or projectors in Japan for United States import. Products for import will be of the type that has been imported by Bell & Howell for some years, including electric eye systems and certain types of lenses.

Willis C. Goss has accepted an appointment to the technical staff of Electro-Optical Instruments, Inc., 1612 East Foothill Blvd., Pasadena, Calif., where he will be engaged in the firm's accelerated development program in the field of instrumentation and high-speed photography. Prior to his present appointment he was with Lawrence Radiation Laboratories where he assisted in the development of high-speed rotating-mirror framing and streaking cameras and multiple-frame Kerr-cell camera systems.

Ralph Bennett has been appointed Manager of the Denver District Office, serving Colorado, Wyoming, Utah and New Mexico, for Gevaert Company of America, Inc., 321 W. 54 St., New York 19. He succeeds Claude Maillard who is now manager of the firm's Industrial Sales Department.

Eric F. Burtis has been appointed to the newly created post of Audio-Visual Market Manager for Keuffel & Esser Co., Hoboken, N. J. The appointment, announced by H. F. Schermerhorn, Vice-President of Marketing, is the first step in a continuing program of expansion in the audio-visual field. Prior to his present appointment, Mr. Burtis was Audio-Visual Product Manager for Technamation, West Coast.

Walter R. Hicks has been appointed Vice-President, Special Projects, Reeves Soundcraft Corp., Great Pasture Road, Danbury, Conn. He was formerly President of Reevesound Co., a wholly owned subsidiary of Reeves Soundcraft Corp. In his new post he will be engaged in the development of special products for the firm and its subsidiaries.

Frank Provost has been appointed Technical Representative in Photographic Instrumentation for Photographic Analysis Company, Clifton, N.J. He was formerly associated with Beckman & Whitley, Inc., San Carlos, Calif.

SYLVANIA ANNOUNCES A SUN GUN MOVIE LIGHT YOU CAN USE ANYWHERE!

NEW
BATTERY-
POWERED
SUN
GUN
30-V



Most versatile movie light ever made!

It goes anywhere. Lights anywhere. Makes it easier for you to shoot effectively under any conditions.

New 30-volt, Battery-Powered SUN GUN Movie Light is completely portable. Gives plenty of light for any job. Allows complete flexibility for every kind of news and location situation.

It's a battery-powered version of the remarkable SUN GUN that Hollywood studios have proved in use for over a year. Com-

plete unit weighs only 16½ pounds including battery. Yet pound for pound it outperforms any other battery-powered movie light made!

The battery pack itself is specially designed for SUN GUN Movie Light by Frezzolini . . . world's leading power pack designer. It measures only 10" wide by 3" deep. Recharges automatically in a short time. Has built-in recharger with automatic cutoff to prevent overcharging, give extra-long life. Battery-powered SUN GUN is easy to han-

dle, completely adjustable, fits any camera. For more details, see your supplier or write SUN GUN Dept., Sylvania Lighting Products, Division of Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.



SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS



old line diversified photographic and audio-visual equipment manufacturer located in the Northeast needs:

an Electronics Engineer having experience with the design of optical and magnetic sound-recording equipment, one with a thorough understanding of photographic and motion-picture sound techniques.

a Mechanical Engineer with experience in design of optical and magnetic sound-recording equipment, together with a broad knowledge of photographic equipment design, including projectors.

a Sound-Recording Engineer experienced in recording motion-picture sound-tracks, transferring, mixing and editing. Must have experience with current high quality recording equipment.

This is an opportunity to work together with a team engaged in finalizing the design of a new series of patented audio-visual and sound products and towards a program of systematic planned improvements of these designs.

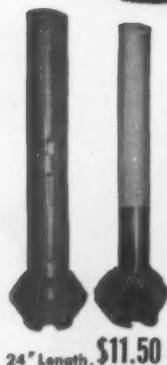
Reply to Box B-11, SMPTE
55 West 42 St., New York 36

CAMART DUAL SOUND EDITOR MODEL SB 111



Edit single and double system 16mm or 35mm optical sound. Edit single system Magnastripe or double system magnetic sound. Use with any 16mm motion picture viewer to obtain perfect lip-sync matching of picture to track. Works from right to left or left to right.

Dual Editor (without viewer).....\$195.00
Zeiss Moviscop viewer.....\$96.00
Special Editor-Viewer comb.....\$269.50



CAMART CORE DISPENSER

Keeps film cores handy at all times. Attach to work table or wall. Easy to remove—easy to fill. All aluminum construction. Adjustable to 16mm and 35mm cores.

Sizes Prices
16" Length...\$9.50
24" Length...\$11.50
36" Length...\$14.50

CAMART TIGHTWIND ADAPTER



• The only tightwind adapter with ballbearing roller.

- Completely scratchproof
- Chrome-plated prevents cinching and abrasions
- Winds film quickly and evenly.
- Fits any rewind.

\$34.95
F.O.B. N.Y.

the **CAMERA MART** inc.

1845 BROADWAY (at 60th St.) NEW YORK 23, N. Y. • Plaza 7-6927 • Cable: Cameramat • www.Columbus

Ray Gallo, head of Ray Gallo Associates, an organization of advertising representatives, has been elected Secretary of the Association of Publishers' Representatives. Among other activities he is Associate Publisher of *International Projectionist* and of *Greater Amusements*. In addition to his activities as publisher he has also engaged in theatrical production.

SMPTE Elections

The results of the 1961 elections were announced at the 90th Convention, Lake Placid. Officers elected (or re-elected) for the 1962-63 term are:

Engineering Vice-President: Deane R. White
Financial Vice-President: Ethan M. Stifle
Sections Vice-President: Garland C. Misener
Treasurer: Wilton R. Holm

Six Governors were elected:

*East Coast—*Harold Jones and Richard E. Putman
*Central—*Geo. W. Colburn and Howard W. Town
*West Coast—*G. Carleton Hunt and Edward H. Reichard

In the Society's Sections, the following Officers and Managers were elected:

ATLANTA: Chairman, Edward E. Burris; *Secretary-Treasurer,* John C. Horne; *Managers,* Edward N. Graham, Alva B. Lines, Katherine A. Stenholm, Harold M. Walker.

BOSTON: Chairman, Robert M. Fraser; *Secretary-Treasurer,* Lester Bernd; *Managers,* Nicholas J. Cedrone, Joseph Dephoure, Edward Kornstein, Joseph Rothberg.

CANADIAN: Chairman, Lou T. Wise; *Secretary-Treasurer,* John Burman; *Managers,* George J. Bova, Charles Frenette, Michael Stechly.

CHICAGO: Chairman, Philip E. Smith; *Secretary-Treasurer,* William D. Hedden; *Managers,* Daniel S. Giroux, Wilfred C. Prather, Jack Whitehead.

DALLAS-FT. WORTH: Chairman, Richard T. Blair; *Secretary-Treasurer,* George E. Krutilek; *Managers,* Bruce Howard, Roddy K. Keitz, Phil Wygant.

DETROIT: Chairman, William H. Smith; *Secretary-Treasurer,* James W. Bostwick; *Managers,* John A. Campbell, Dean Cook, George F. Helberg, Richard O. Painter, Howard W. Town, Robert F. Blair.

HOLLYWOOD: Chairman, Ralph E. Lovell; *Secretary-Treasurer,* John P. Kiel; *Managers,* Edward P. Ancona, Carlos H. Elmer, Fred J. Scobey, De J. White.

NASHVILLE: Chairman, William M. O'Rork; *Secretary-Treasurer,* Herschell R. Briscoe, Jr.; *Managers,* William R. McCown, Paul A. Moore, Duane M. Muir.

NEW YORK: Chairman, Peter Keane; *Secretary-Treasurer,* Arthur J. Miller; *Managers,* Robert W. Byloff, Russell Dupree, Richard Ranger.

ROCHESTER: Chairman, Walter R. Weller; *Secretary-Treasurer,* Harold R. Schroeder, Jr.; *Managers,* Frederick E. Altman, Joseph E. Bourcy, Robert E. Hobkins.

If you're working



in COLOR

know this: many firms process color but

GENERAL FILM



does it

SUPERBLY!



Negative, positive and

reversal COLOR in 8, 16 and 35mm. Serving

producers of television, motion picture,

industrial and audio-visual film



If you're not already "in," why not FIND OUT.

Call  or write.



GENERAL

FILM LABORATORIES

A DIVISION OF PACIFIC INDUSTRIES, INC.

1546 ARGYLE, HOLLYWOOD 28, CALIFORNIA, HOLLYWOOD 2-6171 / central division 1828 WALNUT STREET, KANSAS CITY 8, MISSOURI, GRand 1-0044

November 1961 Journal of the SMPTE Volume 70

921

Specialized LIGHTING EQUIPMENT

for MOTION PICTURE, STILL
and TELEVISION STUDIOS

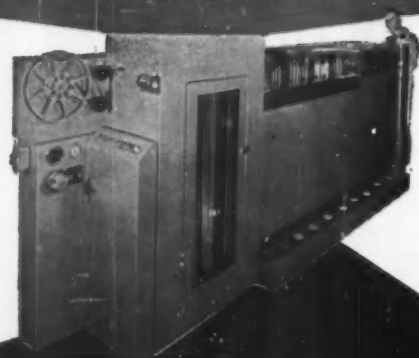
Write for a copy of
Catalog H on Your Letterhead



Mole-Richardson Co.

937 NORTH SYCAMORE AVENUE, HOLLYWOOD 38, CALIF.

Filmline THE
ULTIMATE IN
FILM PROCESSING MACHINES



**CONTROLLED
PROCESSING**
FOR ALL BLACK & WHITE...
AND COLOR EMULSIONS

FILMLINE CORPORATION, DEPT. JS-61, MILFORD, CONN.

SAN FRANCISCO: Chairman, W. A. High; Secretary-Treasurer, Harry N. Jacobs; Managers, R. A. Isberg, Bruce J. Srievers, Clifton R. Skinner.

WASHINGTON, D.C.: Chairman, Arthur L. Foster; Secretary-Treasurer, Arthur Rescher; Managers, Ray B. Dame, Clyde Hunt, Roy L. Sexton, Jr., Carl Turvey.

Obituaries



O. B. Hanson

Oscar Byram Hanson died September 26, 1961, in Norwalk, Conn. at the age of 67. He had been associated with Radio Corporation of America, National Broadcasting Company and predecessor companies for 38 years. He was Vice-President and Chief Engineer of NBC from 1937 until 1954 when he was elected Vice-President of Engineering Services of RCA. He retired in 1959. Following his retirement he continued his association with RCA in the capacity of consultant. During the time he was with NBC, among other activities he designed the studios for WRCA-TV (now WNBC-TV) which had been granted the first commercial TV license; converted radio studios for television; designed studio and master control systems; designed mobile TV units and established facilities at NBC for the introduction of color television.

He was born in Huddersfield, England, February 11, 1894, and the following year the family came to the United States to settle in Connecticut. In 1903 he returned to England for eight years of study at the Royal Masonic Institute, Hertfordshire. In 1911 he returned to America where he worked for the Underwood Typewriter Company of Hartford, Conn., at the same time attending night classes at the Hillyer Institute where he took courses in electricity, drafting and automotive engineering. At the age of 20 he studied at the Marconi School in New York and became a ship radio operator and later joined the Engineering Department of the Marconi Wireless Telegraph Company of America where, in 1918, he was made Chief Test Engineer. This firm was acquired by RCA in 1919.

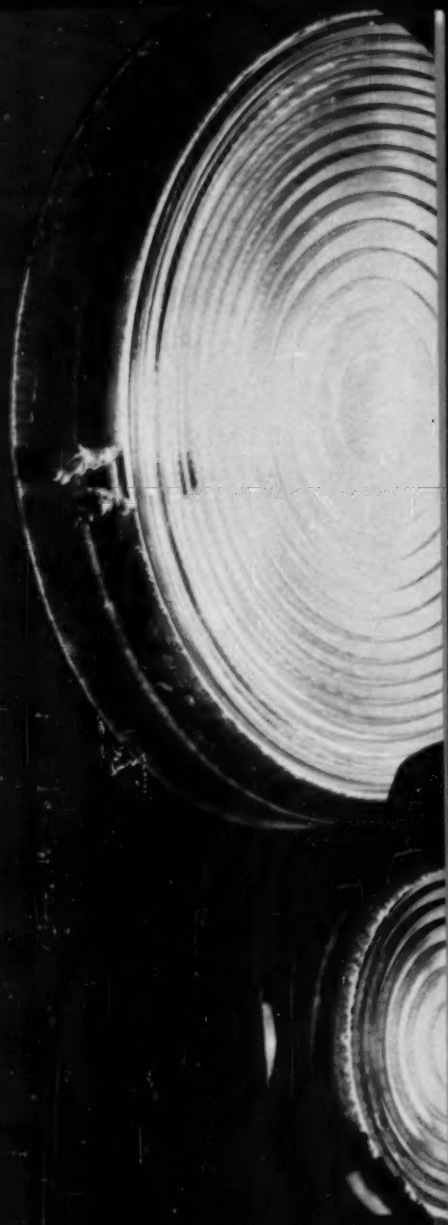
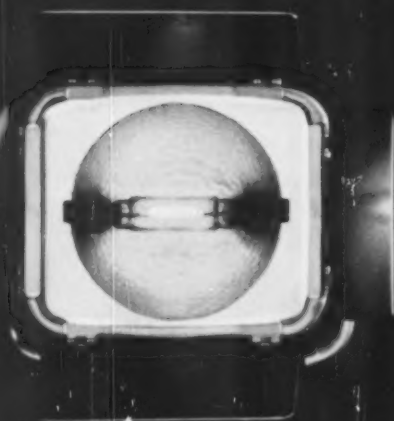
Following World War I, Mr. Hanson joined station WAAM in Newark, N.J., as Chief Engineer.

While with WAAM he designed a microphone for his own use which shortly thereafter came to the attention of other



**NOW
A STUDIO LIGHT
WITH 5000 WATTS
OF EXPOSURE
THAT FITS IN THE
PALM OF YOUR HAND!**

NEW SUN GUN PROFESSIONAL PHOTO LIGHT



takes the place of studio lights 10 times bigger

This is the compact new photo light that has started a revolution in studio lighting. It's a specially engineered PROFESSIONAL version of the SUN GUN home movie light, invented by Sylvania, that major Hollywood studios have already adopted.

The SUN GUN PROFESSIONAL is so small it actually fits in the palm of your hand. So powerful it produces 5,000 watts exposure . . . at only 1000-watts electrical cost. So versatile that it easily does the work of most studio lighting equipment . . . and does it better! And the SUN GUN

PROFESSIONAL weighs only 3 pounds!

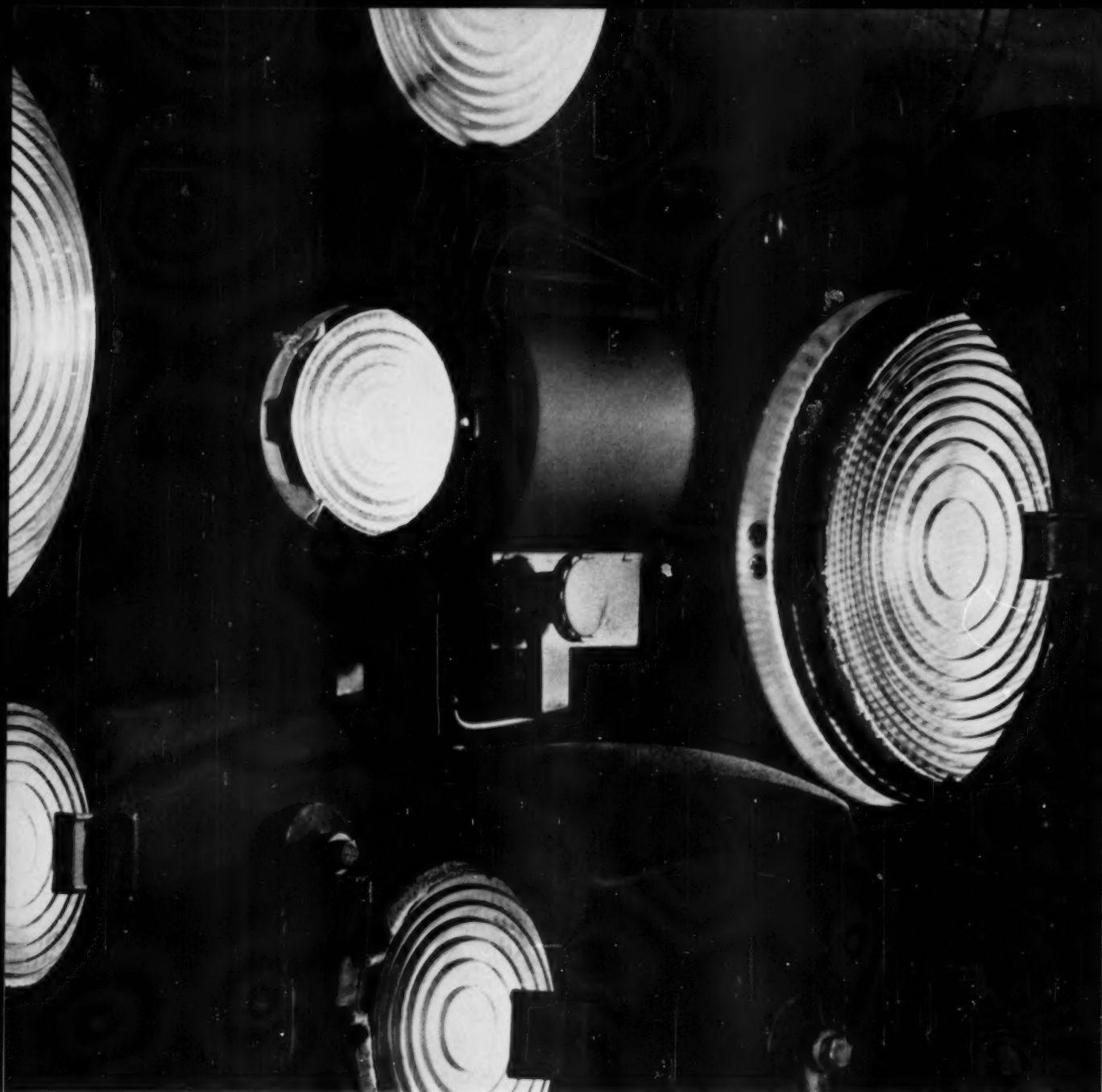
Unlike regular studio equipment, SUN GUN PROFESSIONAL is inexpensive to buy, inexpensive to maintain, inexpensive to ship on location. What's more, SUN GUN maintains original brightness and color temperature for the entire life of the lamp . . . without reducing lamp life!

Where does SUN GUN get its fantastic brilliance? For one thing, it has an amazingly powerful 1000-watt High-Silica Halogen lamp with 65,000 center beam candlepower. It also has a special reflector with over 750 light-intensifying surfaces.

The result is an intensely bright light that floods the scene like the sun. Light is smooth and even. Balanced to 3400°K for indoor color film use. Instantly replaceable lamp has 12 hours' average life.

SUN GUN PROFESSIONAL is completely adjustable. Head can be aimed in any direction. Beam spread is 30° vertical; 36° horizontal. Complete with portrait lens, flood lens, metal barn doors, and 12-foot cord.

Sylvania Lighting Products, Division of Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.



... 10 times heavier... 10 times more expensive!

SEE NEXT PAGE FOR COMPLETE DETAILS ON BUILT-IN FEATURES AND SPECIALIZED STUDIO ACCESSORIES.

SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS



SUN GUN PROFESSIONAL PHOTO LIGHT IS FULLY EQUIPPED FOR EFFICIENT OPERATION, SIMPLIFIED HANDLING, PRECISION LIGHT CONTROL!

COOLING VENTS
For instant escape of heat.

ADJUSTABLE HEAD
Tilts for bounce lighting. Is calibrated 30° below and 90° above horizontal. Control arm makes it easy to tilt and lock head at any angle.

TRANSISTORIZED LIGHT CONTROL
Has dimmer control for modeling and setup lighting levels. Is conveniently located on handle for instant control of light.

UNIVERSAL BRACKET
Fits all cameras. Special bi-position mounting hole allows unit to be located at the side or 30° to the rear of camera.

BARN DOORS
Ruggedized aluminum construction for easy adjustment and placement of light.

12-FOOT CORD

Original equipment also includes:

FLOOD LENS
Dual-purpose lens affords choice of 115° x 50° or 60° x 53° beam for broader light coverage of subject area.

PORTRAIT LENS
Made of specially tempered glass for close-up work.

Full range of optional accessories quickly adapts SUN GUN for every studio lighting need!

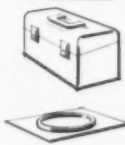


Accessory holder. Adapts SUN GUN to accept the following wide variety of specialized optional accessories:

Daylight filter. Corrects color temperature of basic 3400°K lamp to permit use with daylight type color film. Eliminates need to correct light with camera filters that reduce efficiency of fine camera lenses.



Snoots. Provide a finely controlled beam for spot highlighting of small areas. Two sizes—large and special optical "Sniper Snoot."



Carrying case. For convenient carrying of SUN GUN and accessory lenses.

Super-spread lens. Spreads beam to match field of extra-wide-angle camera lenses. For use with large barn doors or accessory holder.



Large barn doors. Permit horizontal control of light beam to conform to specific area lighting requirements or to keep light out of camera lens.



Special 3200°K filter. High-silica glass, accurately balanced for Type B film.



Diffusing filter. Spun-glass scrim provides soft, even, diffused light for close-up work. Includes removable spread lens.

Sylvania Lighting Products
Division of Sylvania Electric Products Inc.
1740 Broadway, New York 19, N. Y.

Please send me free technical information on the new SUN GUN PROFESSIONAL Photo Light.

Name

Address

City Zone State

MAIL COUPON TODAY FOR MORE INFORMATION



SYLVANIA
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS



radio stations. In 1923 he joined station WEAF (later WNBC), in New York, as Staff Engineer. Later he became Plant Manager and when the station was acquired by NBC in 1926 he was made Chief Engineer. He held many patents for inventions and developments in the fields of radio, television and acoustics.

A Fellow of the Society, he was quietly influential in its affairs for many years. He was also a Fellow of the IRE and of the Acoustical Society of America.

Monroe Sweet

Monroe Sweet, 47, died September 8, 1961, in the crash of a private plane at Binghamton, N.Y. An experienced pilot with many years experience, he was alone in the plane when it crashed as he was attempting to land. It was reported that he was testing the engine before making a flight with a group of photographers.

At the time of his death he was President of Quantametric Devices, Inc., of Binghamton. He had been associated with Ansco Division, General Aniline & Film Corp. for about 20 years, beginning in 1939 when he joined Ansco as a research physicist, specializing in problems relating to production of photographic materials. During the time he was with Ansco, among his inventions and developments were included the Ansco-Sweet Densitometer (described in the February 1942 *Journal* ("A Precision Direct-Reading Densitometer")) and the Intensity Scale Sensitometer. He is the author of "The Densitometry of Modern Reversible Color Film," published in the June 1945 *Journal* and of a number of papers in other scientific publications.

Born in Ossining, N.Y., he was graduated from Wesleyan University in 1937. During 1937 and 1938 he was employed by the Weston Instrument Co. of Trenton, N.J.

He had been a member of the Society since 1945.

section reports



Five hundred persons attended the September 19 meeting of the **Hollywood Section** at the Directors Guild of America Theatre.

The opening film, "The Miracle of Todd-AO," and selected outstanding production excerpts in 70mm, provided through the courtesy of Fred Haynes of Todd-AO Corp., were extremely interesting and drew enthusiastic audience response.

In a paper entitled "A Novel Shutter and Intermittent for a Video Recording Camera," Bill Palmer described a new video recording camera design incorporating a shutter which spreads the picture splice over a time interval of about 40 video lines, resulting in the elimination of shutter bar problems. An extremely rapid pulldown, required by this shutter design is achieved by releasing energy stored in a

THE *light* TOUCH

IN AUTOMATION AND CONTROL

Our robots' eye is the end view of a CL-4000

Clairex Photoconductive Cells, like the human eye, are "windows to the world" of control system design. Our continually expanding line now includes the S-1 series of hermetically sealed Cadmium Sulphide cells, employing a sensitive material formulation that matches the spectral sensitivity of the human eye! These are the first real "electronic eyes" and thus are particularly useful in applications involving human vision, such as Daylight Switches, Photography, and Automatic Brightness Control in Television Receivers.

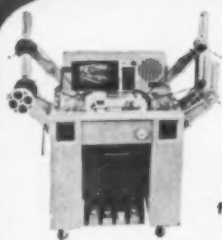


CLAIREX

CORPORATION

New Facilities to meet Growing Needs
100 WEST 30 STREET, NEW YORK 1, N. Y. • MU 4-0940

ACMADE MARK II EDITING TABLE



**Makes
Editing
Easy!**

\$2975

f.o.b. New York

Operation of this simple, efficient editing machine can be mastered in minutes. Continuous (non-intermittent) movement provides absolute protection for your film. Instant controls and declutching allows up to 50% greater speed for pic & sound editing. All combinations of 16mm and/or 35mm channels, plus magnetic and optical sound available.

WRITE FOR DETAILED BROCHURE



**FLORMAN
& BABB, Inc.**

68 West 45th Street N. Y. 36, N. Y.
Murray Hill 2-2928

NEW F & B MARK III FLUID DRIVE TRIPOD



The day of the friction head is fast coming to an end. More cameramen now use fluid drive heads because they meet the demand for smooth, continuous, easily-controlled action.

Complete outfit for 16mm cameras, 35mm Eyemos & Arris, at an amazingly low price. **\$139⁵⁰**

Includes Tripod, Adapter and Visco-matic Fluid Head. With F & B's usual iron-clad guarantee.

Tripod legs only	\$49.50
Baby tripod legs only	47.50
Fluid Head only	97.50
Leather & Vinyl case	12.50
Leather & Vinyl case for Baby	11.50

Serving the World's Finest Film Makers

FLORMAN & BABB, Inc.

68 W. 45th St., New York 36, N. Y.
Murray Hill 2-2928

spring. A fixed register pin locks the film during exposure to insure vertical steadiness. A 16mm film detailing the camera operation, and some sample recordings, were shown. Mr. Palmer is associated with W. A. Palmer Films, Inc., of San Francisco.

"Recent Advances in Travelling Matte Systems," was the title of a discussion by Petro Vlahos of Systems Development Corp. of Santa Monica.

Mr. Vlahos described the sodium system, the color difference system, and a self-matting black-and-white system. For the first time anywhere, details were given of a self-matting black-and-white system whereby the foreground film is self matting for both the foreground and background scenes. Basic problems common to the industry were discussed and specific recommendations were made concerning the need for special equipment and continued development in this field.

Interesting matte shots from MGM's *Ben Hur*, and Walt Disney's *Parent Trap*, were among the illustrations used by the speaker.

A pre-meeting dinner at the Cafe de Paris in Hollywood was attended by 50 people.—John Kiel, *Secretary-Treasurer*, Producers Service Co., 820 South Mariposa St., Burbank, Calif.

The Nashville Section met on September 16 at the studios of WSM-TV with an attendance of 20 members and guests. The featured speaker was Gordon Chambers of Eastman Kodak Co.

Mr. Chambers, in his address entitled "New Kodak Reflex Special Camera and Viscomat Processor," discussed the new Kodak Viscomat Processor, giving background information on the viscous application of processing chemicals, and the development of a new 16mm professional camera. He related the thinking that went into the specifications of the Kodak Reflex Special Camera and had one of the cameras set up for inspection by the audience.

A film prepared by Kodak demonstrating the use of color in the graphic arts showed some unusual and effective high-key color photography.

Coffee and pastries, courtesy of WSM-TV, were served during a discussion period which followed Mr. Chambers' presentation.—H. R. Briscoe, Jr., *Secretary-Treasurer*, 403 Signal View, Chattanooga 5, Tenn.

The New York Section met on September 13 at the Word Affairs Center Auditorium with an attendance of 75. Arthur Miller of Du Art Laboratories read a paper entitled "Fiber Optics for Continuous Printers," prepared by Mr. Miller and Robert Hartshorne.

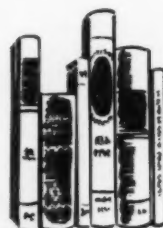
Mr. Miller described the advantages of the incoherent bundle of glass fibers in producing a bright, uniform illumination at the gate of a continuous motion-picture film printer. He also explained the ability of fiber optics to produce a diffuse illumination, with the advantage of minimizing negative defects, and without the great loss of intensity that would result from the introduction of opal or ground glass in the path of conventional optics.

Slides showing a printer with a fiber-optic light source were projected. The

speaker also described methods of using fiber optic bundles in which a percentage of the fibers are detached from the main bundle and which can be used to monitor the light source, or be used for some extreme printing function.

This paper by Mr. Miller and Mr. Hartshorne was printed in the September 1961 issue of the SMPTE Journal.

Attending the meeting were Richard Wilson and Dr. Walter Siegmund of American Optical Co., manufacturers of fiber-optic bundles. These gentlemen participated in the discussion that followed the formal presentation of the paper by Mr. Miller.—Peter Keane, *Secretary-Treasurer*, Screen Gems, Inc., 711 Fifth Ave., New York, N. Y.



books reviewed

Russian-English Dictionary of Science, Technology, and Art of Cinematography

By Val Telberg. Published (1961) by Telberg Book Co., 544 Sixth Ave., New York 11. 103 pp. 8½ by 11-in. Price \$9.80.

The publication at the present time of this notable volume is both a demonstration and a reminder of our expanding cultural relations with the U.S.S.R.—either as the result of private initiative or under the auspices of the Department of State—in the domain that Lenin once called the Soviet Union's "most important of arts," i.e., the motion picture.

As the first Russian-English glossary of film terms ever published, it must be welcomed for the significant timeliness of its appearance among the essential reference books in any basic library. This work has been successfully undertaken by Mr. Telberg, whose qualifications for the task stem from his background as expert photographer and translator from the Russian.

Over two thousand words and phrases are rendered into English in what appears to be a fairly comprehensive coverage of the field. The three categories referred to by the author (science, technology, and art of cinematography) are not set apart; the arrangement is alphabetical throughout and often several meanings are supplied for a given term. Grammatical particulars are omitted, and there is no indication of verbs, adjectives, or nouns, or of the gender of nouns.

The importance of this compilation leads one to regret the minor flaws of its physical appearance. The book, while bound in hard

Auricon; Zoomscope; Super-1200; Pro-600 Special; and Cine-Voice; are Trade-Marks of Bach Auricon, Inc.

Pan-Cinor "85" and "85 S-EK" are trade-marks of Société D'Optique et De Mécanique De Haute Précision, Paris-20, France.

Regular Pan-Cinor "85" Eye-Piece is unscrewed, and Auricon Zoomscope Model 85 used instead.

Auricon Zoomscope Model 85, screws onto Pan-Cinor "85" or "85 S-EK" Zoom Lens (only) without the use of tools; you see same-size image and range-finder as regular "straight-back" Pan-Cinor Eye-Piece.

Pan-Cinor "85", custom-modified by Bach Auricon, Inc. for use with Auricon Pro-600 Special. Zoomscope provides Camera Operator with a comfortable working distance between exit-pupil of the Zoomscope Eye-Piece, and the Camera Door.



Pan-Cinor "85 S-EK", custom modified at extra charge by Bach Auricon, Inc. to fit the Auricon Super-1200 Camera, with Zoomscope Model 85 in use.

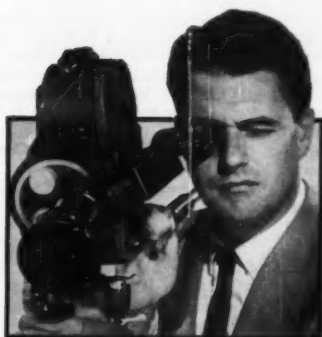


Announcing **BACH Auricon** the new **ZOOMSCOPE**

Extension View-finder Eye-Piece for Model "85" and "85 S-EK" PAN-CINOR Zoom Lenses

The Auricon Zoomscope Model 85 for the Pan-Cinor "85" Zoom Lens provides eye-relief by moving the Camera Operator's eye-position almost two inches away from the side-door of the Auricon camera, while using the Pan-Cinor "85" Zoom Lens. Mounts (without the use of tools) on any Pan-Cinor "85" or "85 S-EK" Zoom Lens View-finder, in place of the regular Pan-Cinor "straight-back" Eye-Piece. Auricon Zoomscope list price \$97.40 for Model 85.

Write for free illustrated information on the Auricon Zoomscope and details covering custom-modification of Pan-Cinor Model "85" and "85 S-EK" to fit your Auricon camera. Write to...



Pan-Cinor "85", custom modified at extra charge by Bach Auricon, Inc., to fit the Auricon Cine-Voice Camera, with Zoomscope Model 85 in use.

BACH AURICON, Inc.
6946 Romaine Street, Hollywood 38, California

The **BACH Auricon** *Line*

AURICON... the Professional Camera
STANDARD OF THE 16MM SOUND INDUSTRY SINCE 1931



CINE-VOICE II
\$997.00 & up



PRO-600 SPECIAL
\$1295.00 & up



AURICON PRO-600
\$1456.25 & up



SUPER 1200
\$4149.00 & up



TRIPOD
\$406.25 & up



**PORTABLE POWER
SUPPLY UNIT**
\$269.50



SOUND RECORDER
\$3643.00 & up

THE HEAD THE HAND THE HEART

When you're ready to print your film, you want the finest prints money can buy. But have you paused long enough to consider exactly what is needed to get prints of matchless excellence?

Some producers are still under the impression that any laboratory with the proper equipment can produce the best prints it is possible to make. This is an erroneous assumption. Granted that almost every laboratory has the necessary equipment, there are other factors of far greater importance.

The secret of obtaining top quality prints lies entirely in the character of the people who make them. They must be master craftsmen—men with keen minds, imagination, skilled hands trained by years of experience, and hearts filled with loving care for all the work they do.

It is because MPL has such craftsmen—craftsmen who take a personal pride in making prints of the finest quality—that our clients have remained steadfastly with us through the years.

We give you 24 hour delivery service anywhere in the United States.

Send your film by AIR—today.

SOUND—EDITORIAL
COMPLETE LABORATORY SERVICES



MOTION PICTURE LABORATORIES, Inc.
781 S. Main Street • Memphis, Tennessee
Phone—Memphis WH 8-0456

The Master Craftsmanship
Your Film Deserves

covers, is not printed, but mineographed from typed stencils, with individual letters occasionally missing or blurred, and some faulty spacing and margins. These are, however, comparatively small details that do not detract for the overall worth of this valuable research and reference tool.—

George L. George, Executive Secretary,
Screen Directors International Guild,
New York.

English-Russian Dictionary of Photography and Cinematography

By A. A. Sakharov. Edited by Prof. E. M. Goldovsky, Central Editorial Board, Foreign Language Scientific and Technical Dictionaries, Fizmatgiz, Moscow, 1960. (Obtainable in U.S., Barnes and Noble, 5th Ave. and 18th St., New York, N.Y.). 395 pages. Price 14 rubles 95.

The introduction to this dictionary states that it is the first to be published on the subject in the Soviet Union and that it contains about 10,000 words and expressions directly connected with the motion-picture and the photographic industries. It is intended not only for motion-picture engineers, but also for students learning cinema techniques, amateur movie makers and various specialists using photo and film in their daily work.

In preparing this dictionary the compiler has drawn widely on handbooks and periodicals published in the last twenty years (the ten volume encyclopedia "The Complete Photographer" and the "Encyclopedia" published by Focal Press in London are specially cited). Reference is also made to previously published multilingual dictionaries outside the Soviet Union—King, Elsevir (Clason), Gauda, etc.

The main part of this dictionary (287 pp.) is taken up by an English-Russian list but a very short list of English and American abbreviations is included and also an index of Russian words which might be useful to a person translating from Russian into English. A number is printed after each Russian word referring to the English word in the front part of the dictionary. Certain errors (such as Movieton, Grew, Cinemascope) and omissions (Akeley camera, script-girl, variable focal-length lens, etc.) are evident but this book will nevertheless be very useful in the United States.

(The dictionary is available in France, at a price of little more than 2 U.S. dollars, from a book shop which specializes in publications from Eastern European countries.) Finally, it is interesting to note that 8,000 copies of this dictionary have been printed in the first edition.—Alexis N. Vorontzoff, 10 Rue Mademoiselle, 10 Paris XV, France.

Membership Certificates (Active and Associate members only). Attractive hand engrossed certificates, suitable for framing for display in offices or homes, may be obtained by writing to Society headquarters, at 55 West 42d St., New York 36, Price: \$2.50.

current literature



The Editors present for convenient reference a list of articles dealing with subjects cognate to motion-picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer vol. 42, Sept. 1961
Kodak's New Reflex Special 16mm Camera (p. 534)

British Kinematograph vol. 38, Apr. 1961
Past, Present and Future Trends in Sound Recording Techniques (p. 88) F. W. Rennie
Rapid Reversal Process and Special Projection System for Film Patrol (p. 96) E. R. Townley

Film Technikum vol. 12, June 1961
Tontechnik, Lautsprecher werden gemessen

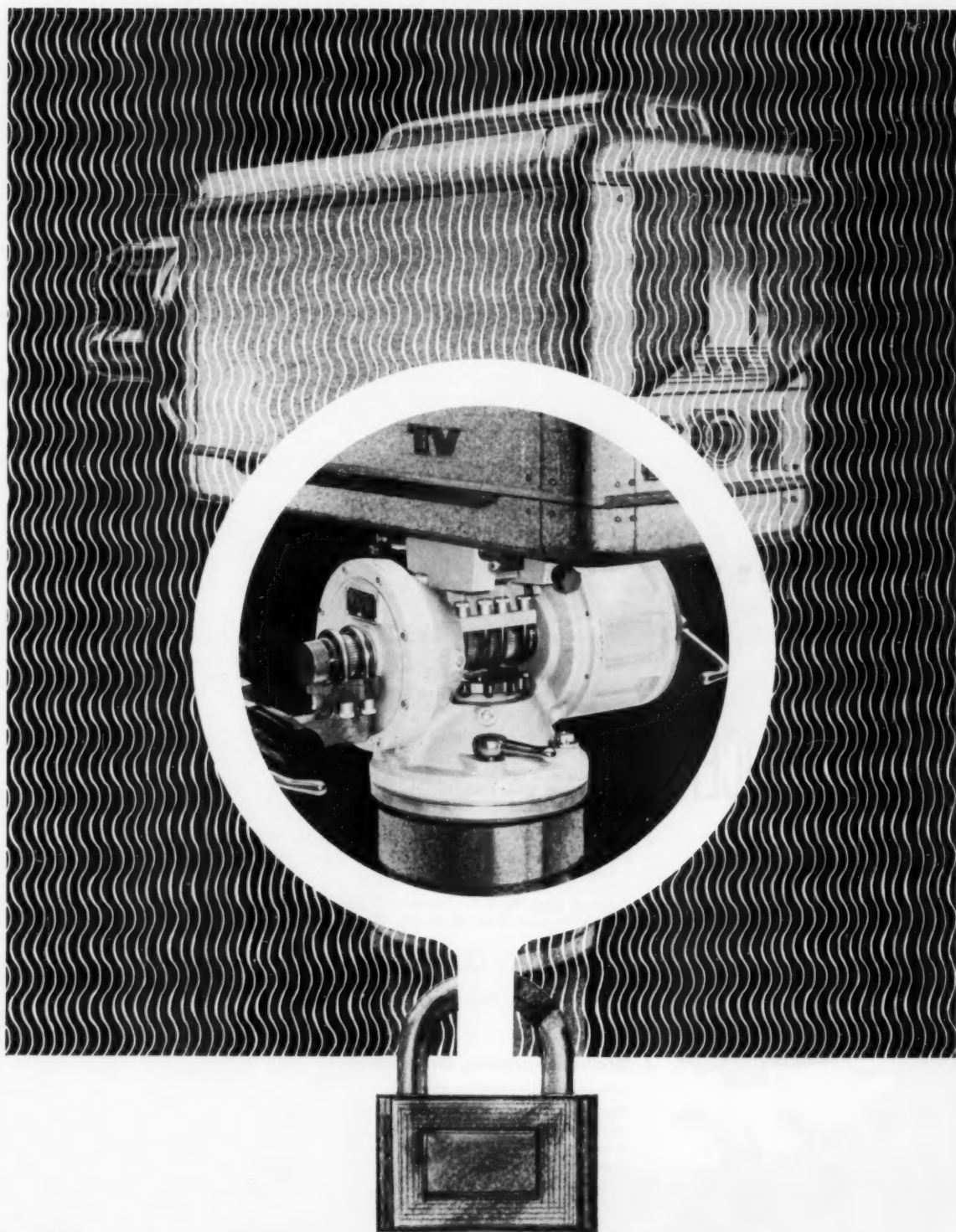
International Photographer vol. 33, June 1961
Kodak Rapid Processor (p. 112)

Jour. Brit. IRE vol. 21, Apr. 1961
Television Anomalies—Past, Present and Future (p. 291) L. H. Bedford
On the Problem of Magnetic Focusing of a Beam of Electrons Emitted With Thermal Velocities (p. 337) J. Vojvodova

Jour. Phot. Sci. vol. 9, May/June 1961
Latent Image Reactions With Mercuric Chloride (p. 145) D. M. Spracklen
Role of Gelatin in Photographic Emulsions (p. 151) H. W. Wood
The Dual Mechanism of Latent-Image Formation in Photographic Emulsions (p. 157) E. A. Sutherns and E. E. Loening
Nanosecond Light Sources (p. 165) G. Porter and E. R. Wooding
Effect of Plate Making Conditions on the Tone Rendering Obtained Using Non-Dichromate Sensitized Lithographic Plates (p. 180) S. D. Winn and L. E. Lawson
Equivalent Quantum Efficiency and the Information Content of Photographic Images (p. 188) E. H. Linfoot
Solarization: Reversal Effects Arising From Variation of Developed-Grain Size With Exposure (p. 195) G. C. Farnell and J. B. Chanter
On Necessary Measurements for the Characterization and Optimum Use of Photographic Materials for Scientific Purposes (p. 201) P. B. Fellgett
Comparison of Flash Light Sources by the Open Shutter Method (p. 207) George H. Lunn
Estimation of Restraints (p. 210) P. S. Gordon and E. D. Swann

vol. 9, July/Aug. 1961
Reliability of Bleaching Techniques for the Determination of Latent Image Distribution in Silver Bromide and Iodobromide Emulsions (p. 217) E. A. Sutherns
Electrokinetic Measurements on Silver, Silver Bromide and Silver Sulphide (p. 222) J. Barr and H. O. Dickinson

Jour. Radio Research Lab (Japan) vol. 8, Jan. 1961
Theory of Cross Relaxation in Maser Materials (p. 1) M. Hirano



"THE SHAKES" PERMANENTLY LOCKED OUT

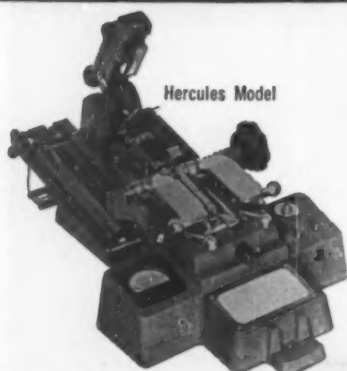
**O'CONNOR
FLUID HEADS**

"the secret to a steady hand"

9862 Highland Avenue, Alta Loma, California.

Brochure on request.

NEW INTERMIX PRESTO-SPLICER HANDLES EVERY JOB



Hercules Model

Newly modified Presto-Splicer butt-welds motion picture film, microfilm, acetate, mylar, Polyester, safety-base, paper . . . or any other kind of tape or film . . . AND INTERMIXES ANY OF THESE MATERIALS making a failure-proof, invisible weld that is literally the strongest part of the tape. Every splice you make will be a cleaner splice . . . a stronger splice . . . a PERMANENT splice, with

PRESTO-SPLICER

Slide handle toward you as far as it will go. This brings the special Mylar® tape with thermal setting adhesive into position.

Splice in the usual manner. Heat sets the adhesive but does not disarrange the molecular structure of the tape. The bond is permanent, stronger than the film itself.

Use the trimmer to remove the surplus tape. The entire procedure is so simple, so positive, that no special training is needed for your existing personnel.

*T.M. E. I. duPont de Nemours & Co.

For further information, write

**PRESTOSEAL
MANUFACTURING CORP.**
37-27 33rd Street
Long Island City 1, N. Y.

Represent: Reeves Equipment Corp.
P. O. Box 171, Pelham, N. Y.

The Adsorption of Developing Agents to a Dropping-Mercury Electrode (p. 234) *P. J. Hillson*

Some Notes on Maxwell's Colour Photograph (p. 243) *R. M. Evans*

Towards the Ultimate Speed in Photography (p. 247) *G. I. P. Levenson et al (Symposium)*

Calculation of Limit Sensitivity in Photographic Layers (p. 254) *K. V. Vendroosky and V. I. Sheberstov*

Uses of Photography in Chemical Engineering Research Projects (p. 260) *J. Liddell, C. Ramshaw, A. Thoburn and R. J. Dalton*

Kino-Technik vol. 15, April 1961
Umkehrentwicklungsverfahren für die Fernsehaufzeichnungen auf Telerecording-Film (p. 99) *E. Pochadt*

Aufbau und Arbeitsweise von Farbfernsehanlagen (p. 105) *H. Jensen*

Pegelverlust bei magnetischen Aufzeichnungen (p. 112) *F. Trommer*

vol. 15, No. 6, 1961
Die optimale Gradation des projizierten Bildes (p. 169) *W. Behrendt*
Verbesserte Magnettonfilme für das Atelier (p. 173) *H. Hörmann*
Neue Tendenzen in der 8-mm-Geräteentwicklung (p. 175) *G. Hauffer*

vol. 15, Aug. 1961
Die Optik der Farbfernsehkamera (p. 225) *H. Jensen*
Röntgenblitz-Kinematographie bei Frequenzen bis zu 12000 B/s (p. 229) *G. Thomsen*

Photo-Technik-Wirtschaft, vol. 12, June 1961
Auch die 8-mm-Heimprojektion hat ihre Gesetze (p. 196) *H. Ulfers*

Vol. 12, April 1961
Die Schmalfilmkamera bei Untersuchungen in Wissenschaft und Technik (p. 96) *F. Fress*

Proc. Inst. Electrical Eng. Pt. B, vol. 108, Mar. 1961
Phase Variation of Very-Low-Frequency Waves Propagated Over Long Distances (p. 214) *B. G. Pressy, G. E. Ashwell and J. Hargreaves*

RCA Rev. vol. 22, June 1961
Helix Parametric Amplifier: A Broadband Solid-State Microwave Amplifier (p. 219) *C. L. Cuccia and K. K. N. Chang*
Optimum Band Shape for Television Intermediate-Frequency Amplifier (p. 245) *T. Murakami*
Suppression and Limiting of Undesired Signals in Traveling-Wave-Tube Amplifiers (p. 280) *H. J. Wolkstein*
High-Beam-Velocity Vidicon (p. 305) *J. Dressner*

Books, Booklets, Brochures

Planning Schools for New Media is a profusely illustrated (photographs, diagrams and drawings) 72-page manual prepared by three educators, Amo De Bernardis, Victor W. Doherty and Errett Hummel, and an architect, Charles William Brubaker, in cooperation with the Office of Education of the Department of Health, Education and Welfare. The purpose of the publication is to assist school board members, school superintendents and architects to plan school buildings so that teachers may make full and effective use of modern media of instruction. Preparation of the manual was performed under a contract made in accordance with the provisions of Title 7, Part B or the National Defense Education Act of 1958.

Films Incorporated, a subsidiary of Encyclopaedia Britannica Films, Inc. has issued a 160-page catalog (62-A) which lists hundreds of 16mm sound feature films and short subjects available on a rental basis. The service is mainly for schools, colleges and universities, shut-in institutions, social service centers, boys clubs, neighborhood houses, summer camps, churches and theaterless towns. Information is available from Films Incorporated, 1150 Wilmette, Ave., Wilmette, Ill.

More than three thousand journals, papers, selected books and other publications are indexed and annotated by Engineering Index, Inc., 345 E. 47 St., New York 17. The service is divided into 249 fields of interest. The Index issues annually a bound volume and maintains a card index service mailed weekly to subscribers.

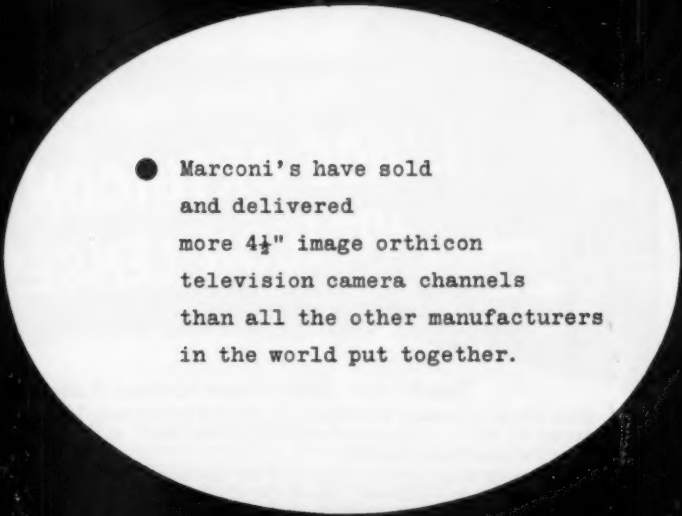
Densitometers for density measurements of color and black-and-white positive or negative motion-picture films and optical soundtracks are described in a brochure available from the Westrex Recording Equipment division of Litton Systems, Inc., 335 N. Maple Dr., Beverly Hills, Calif., by requesting Bulletin 3.9. Descriptions and illustrations are included in the six-page brochure.

Magnetic films are described in a brochure which illustrates in color and describes in detail nine types of magnetic film (five with standard oxide coating, three with high output oxide, and one with heavy duty oxide). It is available upon request from Carl J. Andrews, Advertising Dept., Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minn. The brochure also contains information on splicing, erasure, cleaning and handling, and storage techniques.

Motion-picture lighting kits are described in an 8-page illustrated catalog of Colortran kits available from Natural Lighting Corp., 630 S. Flower St., Burbank, Calif. The catalog contains technical data on 16 kits for lighting areas of 15 × 20 ft through 20 × 40 ft. The kits are designed as units to fit into carrying cases. Components such as converters, lights, stands, grips, etc., are described. The firm also offers without charge a 4-page illustrated catalog of 3-wire custom power cables.

What's New in Photo Lamps and Lighting is a leaflet published by the Photo Lamp Department, General Electric, Nela Park, Cleveland 12, Ohio. Issue No. 17, dated August 1961, discusses the "Natural Look With Flash Outdoors," and takes up unusual lighting situations. Some suggestions are offered as to basic minimum equipment and a list of suggested filters for various types of light sources is given.

A 100-page catalog with 300 illustrations describing equipment for commercial and industrial motion pictures, television and photoinstrumentation is available from Gordon Enterprises, 5362 North Cahuenga Blvd., North Hollywood. Also included is reference material illustrated with charts and graphs.

- 
- Marconi's have sold and delivered more 4½" image orthicon television camera channels than all the other manufacturers in the world put together.

The MARCONI MARK IV camera is distributed in the U.S.A. solely by:
AMPEX Video Products Company, REDWOOD CITY · CALIFORNIA
Manufacturers of the VIDEOTOPAPE Television Recorder

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED · CHELMSFORD · ESSEX · ENGLAND

A Survey of Photographic Instruction, 2d ed., 1960, a résumé of instruction in American colleges, universities, technical institutions and schools of photography, is an Eastman Kodak publication (Pamphlet No. T-17). The pamphlet contains a list of colleges and universities offering courses in photography together with a brief description of the courses offered and also a list of Schools of Photography. This information is based on a survey completed in 1960. Only 1250 replies were received in response to 2100 questionnaires. Of the 1250 schools replying, 400 reported one or more courses in photography; 250 reported catalog courses in other subjects that include instruction in photography; 175 reported catalog courses in audio-visual materials; 30 offer minor credit in photography; 50 offer major credit in photography; 100 offer photography instruction in summer sessions; and 150 reported the employment of one or more full-time photography instructors.

A brief analysis of the survey presented in the pamphlet includes a discussion of certain interesting trends brought out by a comparison of the answers to questionnaires in this survey with the answers received in the survey made a few years ago. Trends noted in analysis include a marked and predictably continuing increase in instruction in audio-visual materials and methods, and also an increasing emphasis on photography in nonphotographic courses, such as the various sciences, medicine, art, etc.

Abstracts

Abstracts from other Journals, chosen for importance and timeliness, are published in the *Journal* from time to time. The greater numbers of these abstracts are translations, chiefly from the U.S.S.R., and made available by the *Kodak Monthly Abstract Bulletin*.

The subject areas are grouped below

Cameras and Equipment (except High-Speed)
Cinematography
Color Photography and Color Development
Film and Its Properties
Film Processing (Apparatus and Chemicals)
General
High-Speed Photography and Instrumentation
Printing and Optics
Projection
Sound Recording and Reproduction
Television

CAMERAS AND EQUIPMENT (Except High-Speed)

The Preparation of a Beam-Splitting Block for a Special-Effects Camera (in Russian), L. M. Glotova, *Tekh. Kino i Televideniya*, 5: 53-56, Mar. 1961.

In 1958 the NIKFI Laboratories introduced a traveling-matte technique into the Soviet film studios and produced the TKS-3

camera for special effects, including the traveling matte. The construction of the beam-splitting block used in that camera is described. It is made up of four right-angled prisms, two with an angle of 60° , and two with an angle of 45° , assembled so that a space is left between the two exit (45°) prisms for the passage of the film pack.—S.C.G.

Cameras for Amateur Cinematography (in Russian), N. Panfilov, *Kinomekhanik*, 24-28, Mar. 1961.

Brief descriptions, with tabulated data, are given for a range of amateur 16mm and 8mm cameras available in the U.S.S.R.—S.C.G.

Apparatus for the [Soviet] Cinema Network in 1961 (in Russian), G. Gnevyshev, *Kinomekhanik*, 2-5, Feb. 1961.

A range of equipment for Soviet cinemas at present available and to come into production during 1961 is reviewed.—S.C.G.

At the "Mos'film" Motion-Picture Studios (in Russian), G. Kh. Tekh. *Kino i Televideniya*, 5: 66-67, Mar. 1961.

A bayonet-type mounting for an anamorphic optical system for a motion-picture camera and an anamorphic attachment for projection in use in the Mos'film studios are briefly described.—S.C.G.

Motion-Picture Camera Objectives and the Criterion of Sharpness, A. L. Yarinovskaya, *Tekh. Kino i Televideniya*, 5: 29, Apr. 1961.

A method of defining the quality of an optical image by the criterion of sharpness with the help of edge gradient curves is considered. A quantitative evaluation by this criterion is proposed. The influence of stopping down the objective on the optical and photographic resolving power and on the image sharpness is explained.

The agreement of the results of objective quality determined with the help of optical image assessment by the criterion of sharpness, with the general evaluation of a photographic image is considered.

A Device for Testing the Setting of Objectives and the Position of the Ground-Glass Screen in the "Konvas-Automat" Motion-Picture Camera (in Russian), B. A. Shardin, *Tekh. Kino i Televideniya*, 5: 63, Jan. 1961.

Frame-by-Frame Filming with the Kiev-16C-2 Camera (in Russian), P. A. Degtyarev, *Tekh. Kino i Televideniya*, 5: 65-68, Jan. 1961.

A description is given of the mechanical alterations and electrical circuit used in converting a Soviet Kiev-16C-2 camera for time-lapse cinematography.

Investigation of the Noise of Motion-Picture Cameras and Developing Methods for its Reduction (in Russian), L. I. Zaets, *Trudy NIKFI*, No. 34, 101-109, 1960.

Changing the design of the gears and

Off-The-Shelf Delivery!

**IMAGE-ORTHICON,
VIDICON LENSES**

Rent or Buy Image Orthicon Lenses
from World's Greatest Selection . . . choose from 28mm focal length to 60" . . . delivered right "Off-The-Shelf" at B & J World's Lens Headquarters!

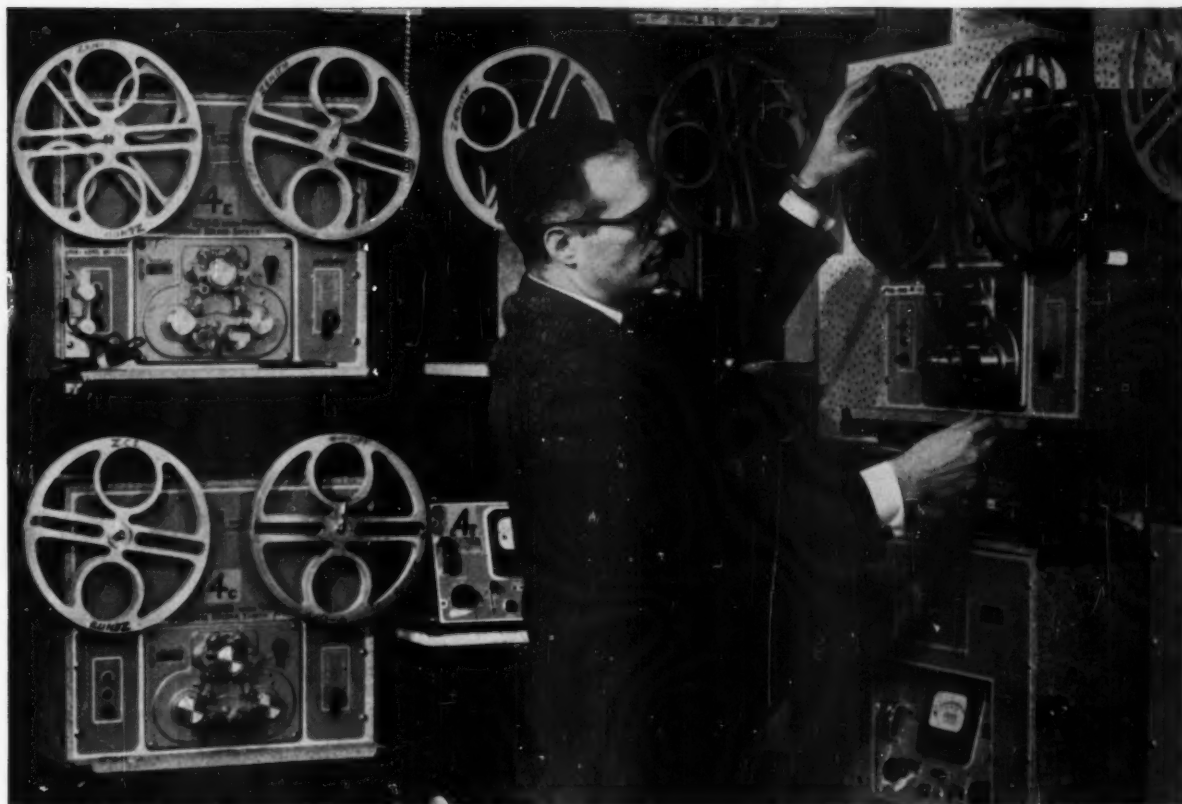
Here you'll find the lens you need for practically ALL T.V. Cameras, R.C.A. (TK-41, TK-11); G. E. Black and white or color, Du Mont, etc. Rely on the Industry's Prime Optics-Source . . . Pioneers in T.V. Optics Since 1936 and currently serving such stations as WGN, WNBO, ETC.

Our Instrument Shops and "Know-how" offer you Special Mountings, Calibration and Custom Fittings! (Also Cine & Slide Equipment for your News Dept.!)

Write for New T.V. Optics Catalog.



BURKE & JAMES, INC. 321 S. Wabash, Chicago 4, Ill.



For unsurpassed quality specify...

SCOTCH® BRAND MAGNETIC FILM

...“sound” standard of the industry!



Today's top motion picture sound engineers who can't afford to gamble with quality, insist on "SCOTCH" BRAND Magnetic Films for the very best in sound. With "SCOTCH" Films on the scene, sound comes clear and clean . . . with maximum frequency response, greater dynamic range with minimum distortion, excellent uniformity, and low noise level.

There are many reasons why experienced users of magnetic sound have voted "SCOTCH" BRAND No. 1 choice of the industry. Made by the company that pioneered magnetic film, audible range tape, instrumentation tape, and video tape, "SCOTCH" Films have the highest uniformity of any magnetic films made! Uniformity is constant—from reel to reel, and within each reel. These films permit a maximum number of re-recordings with virtually no loss in quality and stand up under the most rugged recording conditions found on location. And all films feature exclusive Silicone lubrication that reduces flutter, prevents head wear, and extends film life.

Two 16 mm "SCOTCH" Films to remember—available full-coated, either single or double perforated, in 400, 800, 1000, 1200 ft. lengths.

No. 316 * . . . a Standard Oxide film, is the professional standard the world over for sound excellence on 16 mm. Its uniformity, dynamic range, freedom from distortion, provide top quality for original recordings and subsequent re-recordings. Widely used for news pickups, industrial and educational filming and television.

No. 326 * . . . a High Output Oxide film, offers the same quality recording advantages as No. 316. However, it provides greater output, increased signal-to-noise ratio, and more than adequate protection against overloads.

3M also makes "Scotch" Films in 35 mm, with a wide choice of full-coat, stripe coated, or clear edge . . . in 1000 ft. lengths . . . edge-numbered or non edge-numbered . . . in standard and high output oxides. 17.5 mm films, full-coated, are available in standard or high output oxides with or without edge numbering . . . as well as a complete line of Splicing Tapes. Write for free, illustrated brochure to 3M Company, St. Paul 6, Minn.

*New numbers: No. 316 was formerly 116; No. 326 was 126.

"SCOTCH" and the Plaid Design are reg. TM's of the 3M Co. © 1961 3M Co.

Magnetic Products Division **3M**
COMPANY

mounting of the 2KSS motion-picture camera reduced the operation noise from 62 to 27 db. A change in lens design and minimizing the effect of mechanical vibration on the lens will be necessary for a greater reduction of noise.

COLOR PHOTOGRAPHY AND COLOR DEVELOPMENT

The Processing of Color Negative Films (in Russian), Ts. S. Arnol'd and L. P. Krylov, *Tekh. Kino i Televideniya*, 5: 13-19, Mar. 1961.

The new Russian negative color films DS-5 and LN-5, containing masking couplers, required a somewhat different processing from the earlier films which they supersede. The new processing technique worked out for them may also be used with the older films. The new process is more stable, gives more reproducible results and is designed to interfere as little as possible with masking properties of the couplers, to give maximum film speed and to give minimum fog. Sensitometric data are given to show how the processing behaves in practice.—S.C.G.

A New Set of Color Motion-Picture Films (in Russian), A. N. Iordanskii, I. M. Kilinskii and Yu. B. Vilenskii, *Tekh. Kino i Televideniya*, 5: 4-13, Mar. 1961.

New Russian color motion-picture films with improved color separation and re-

solving power are described. The DS-5 negative stock, balanced for daylight and arc light, has masking couplers in the middle, green-sensitive and bottom, red-sensitive layers. There is no colloidal-silver layer, but the top, blue-sensitive layer is dyed with a yellow dye which is removed during processing. The overall thickness of the emulsion layers has been reduced from 27 μ (in the DS-2 film which the DS-5 replaces) to 19 μ . The silver-halide/gelatin ratio has also been altered so as to increase the resolving power. Speed has been sacrificed and the DS-5 is about half as fast as the DS-2.

The corresponding positive film, TsP-7, has a green-sensitive (magenta) layer at the top, followed by the red-sensitive (cyan) and blue-sensitive (yellow) layers. The magenta coupler has been improved. The emulsion layers are dyed to reduce light scatter, the dye being removed during processing. Resolving power has been increased to 200-250 lines/mm.

Other films in the series are the LN-5, a color negative film for tungsten lighting, and the KP-4 duplicating film for use with either negative stock. The films are all made by the Shostinskii factory.—S.C.G.

Points in the Kinetics of Color Development (in Russian), V. I. Uspenskii and N. I. Rodionova, *Zhur. Nauch. i Priklad. Fotografii i Kinematografii*, 6: No. 2, 125-129, Mar.-Apr. 1961.

In color development of gelatin silver-bromide layers containing nondiffusing

color couplers for which the formation of the dye passes through a stage in which a leuco-base is formed, the relations between the density or gamma of the dye image and the duration of development for all concentrations of the couplers, including relatively small concentrations, are expressed by straight lines, while the kinetics of the growth of silver density is expressed, as usual, by a curve with a gradually decreasing gradient.

This type of kinetics of the development of a color image is explained thus: on color development for a dye image, no lowering of the covering power of the dyes occurs on prolonged development, while for the silver image, the photometric equivalent of the silver alters in the appropriate manner.

For couplers which do not give rise to leuco-bases during the formation of the dye, the kinetics of development of the image from the dyes shows for most cases a slowing-down with prolongation of development, and in this respect is similar to the kinetics of black-and-white development.

FILM AND ITS PROPERTIES

Overcoming Being Behind in the Film Quality in a Short Time, E. M. Geller, *Tekh. Kino i Televideniya*, 5: 1-4, Apr. 1961.

A meeting of the Technical Council of the Ministry of Culture of the U.S.S.R., enlarged by the inclusion of representatives of the film factories and other interested bodies, was held on Feb. 6-7, 1961, for the discussion of shortcomings in current Soviet motion-picture film stock. Color films are particularly open to criticism and their improvement has been slow. Black-and-white films are good individually, but insufficient attention has been paid to matching the characteristics of negative, positive and duplicating stocks. Complaints are made of large batch-to-batch variations in properties and the occurrence of mechanical and other defects. Processing is inadequate, as regards both general quality and uniformity.

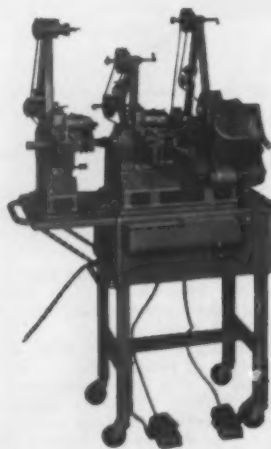
It is considered that insufficient research has been put into the subject by the research institute, NIKFI, and the factories, and that NIKFI has failed to coordinate the activities adequately. The supply of raw materials and semifinished products also comes in for criticism.

A number of measures were adopted and targets set for the rapid improvement of Soviet film stocks.

Immediate Prospects for the Development of the Material and Technological Resources of Kinematography (in Russian), *Tekh. Kino i Televideniya*, 5: 1-6, Jan. 1961.

Plans for the development of the motion-picture industry in the U.S.S.R. are discussed. During 1961 several studios are to be constructed or reconstructed. The production of film of all types is to be raised by 125 million meters over that of 1960; and an improved black-and-white positive stock and new color films, including a color negative with integral masking, are to be introduced. Materials for the imbi-

ADD A SOUND HEAD to your MOVIOLA for multiple sound track editing



*Model UD-20-S shown with cabinet extension and extra sound head.



Cabinet extension bracket with mixing controls and coupling attachments complete.

\$7750



16mm or 35mm** Optical and magnetic sound head.

\$49500

1. Provisions for separate magnetic volume control over each sound head.
2. Plug-in attachments to amplifier.
3. Strong, easy to install from furnished instructions.

*Specify existing model Moviola for which extension is required.

**Specify 16 mm or 35 mm when ordering separate sound head.

Moviola

MANUFACTURING CO.

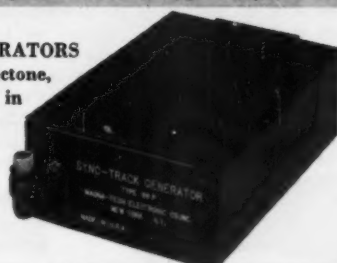
1451 GORDON STREET • HOLLYWOOD • CALIFORNIA • HO. 7-3178



SERIES 78 BATTERY-POWERED SYNCHRONOUS INVERTERS

provide a source of 115V A.C. 60 cycles for synchronous operation of equipment in the field. A 10 minute take made with cameras and film recorders driven from these Inverters will be in precise lip-sync $\pm \frac{1}{4}$ frame. 50 Watt thru 500 Watt models are available for driving all cameras, such as Mitchell, Arriflex, Auricon, etc. or any film recorders. All solid state, the unit pictured above, Type 78A, 50 Watts, weight 5 pounds.

SERIES 88 BATTERY-OPERATED SYNC TRACK GENERATORS for recording 60 cycles on $\frac{1}{4}$ " tape. Used with Nagra, Perfectone, or other battery operated tape recorders. All solid-state, fits in jacket pocket, or outboard on recorder. Also, A.C. powered Type 87, for 14KC sync track, available. All new, Series 78 and 88 provide *totally linkless* Double-System synchronism on location.



TYPE 92B PLAYBACK SYNCHRONIZER FOR SYNCHRONIZATION OF $\frac{1}{4}$ " TAPE IN PLAYBACK WITH SPROCKET DRIVEN FILM



Responsible for tape to film transfer? Check out this addition to the distinguished MTE line of synchronizing equipment. You'll find no other gives you all of the 92B's important benefits:

WIDE RANGE, can correct speed deviations of +20% to -20% from sync speed.

CONTINUOUS DISPLAY OF SYNC CONDITION so user knows exactly whether tape is in sync. Oscilloscope semi-circle pattern moving clockwise indicates tape speed fast, counter-clockwise indicates tape speed slow, semi-circle standing still indicates precise sync speed. In addition, Comparator-driven dial registers % deviation from $7\frac{1}{2}$ or 15 i.p.s. normal speed. **SYNC SIGNAL LEVEL IS INDICATED BY VU METER**, an Attenuator provides for boosting weak signals 20 DB. Also a Volt Meter indicates voltage to capstan motor.

HAS MEMORY if sync signal is lost, tape runs at last sync-controlled speed.

ADVANCING OR RETARDING TAPE TO LIP-SYNCHRONISM with picture, when screening, is achieved with a Spinner Knob Framing Control.

VERSATILE REMOTE CONTROLS for operating tape recorder at the Synchronizer are incorporated.

FULLY AUTOMATIC. Choice of automatic speed control for sync transfer work or manual speed control for special effects, pitch change, trimming time spots, etc.

COMPACT. All solid state. Entire 92B unit mounts in $12\frac{1}{4}$ " of rack space, weighs 38 lbs.

COMPATIBLE. Can be used with tape transports including Ampex 350, 351, 354, 300, 400 and others. Uses 60 cycles or 14KC control track supplied by MTE type 87, 88, or any other control track generators, or sync head.

ECONOMICAL. High utility in film studios, music studios, in-plant film production facilities. Solid state reliability eliminates maintenance. **Only \$1,920.00**

Write for 44-page Catalog

M.T.E.

MAGNA-TECH ELECTRONIC CO. INC.
630 9TH AVE. N.Y. 36, N.Y.

tion process are being successfully developed. A new matrix and blank film are to be introduced during the year, but the situation is not completely satisfactory and manufacturing methods need to be improved. Printing and processing laboratories are to increase output by the continued introduction of mechanization and new equipment is being produced. More cinemas, of different sizes, are to be built, the larger being fitted out for wide-screen and panoramic projection.

Design of the Instrument and the Method of Measurement of Electric Resistance of a Motion-Picture Film Support and Its Antistatic Coatings (in Russian), A. I. Bukin, A. M. Bolotovskaya, L. G. Gross and B. Ya. Sheleiko, *Trudy NIKFI*, No. 37, 123-131, 1960.

The first part of the paper describes the instrument and its operation, while the second part gives results of test of lacquer coatings of the support and a description of the method used. The following conclusions can be drawn:

- (1) The maximum error of the instrument, as compared with the standard, is 5.0%. The variation between results in parallel tests of samples of the support, without lacquer coating and the subbing, amounts to $\pm 6.0-7.5\%$, while the same for the subbed support amounts to $\pm 7.5-10\%$.
- (2) The instrument can be used in the existing form for research and production inspection.

(3) The best reproduction results are obtained when the instrument is kept at constant temperature and relative humidity of the room.

(4) The instrument can be used for determining the specific surface and volume resistance p_v of the support and motion-picture films up to 10^{18} ohms. It has been determined that the volume resistance depends upon the thickness of the support.

FILM PROCESSING (Apparatus and Chemicals)

Calibrated and Uniform Application of Processing Solutions on a Continuously Moving Film, S. M. Levi, N. G. Maskenkova and N. I. Kirillov, *Tekh. Kino i Televideniya*, No. 12, 18-25, 1959.

The chief conditions ensuring a calibrated and even application of processing solutions on a continuously moving photographic film are examined. Equations show the dependence of the volume of the applied solution on various factors for different types of solution-applying apparatus. The action of wetting agents was studied and conditions are indicated for an even distribution of the solutions on the surface of the film. A study was made of the effect of different wetting agents on the evenness of application of developing and fixing solutions. (From *Referat. Zhur. Khim.*, 1960.)

Application of the 40P-1 Developing Machine to the Combined Processing of 16- and 35mm Films (in Russian), V. Malinskii, S. Leshov, I. Vologodskii, I. Ryabovalov and A. Gribov, *Tekh. Kino i Televideniya*, 5: 63-64, Jan. 1961.

CINEMATOGRAPHY

40 Jahre Deutsche Kinotechnische Gesellschaft im Lichte der kinotechnischen Entwicklung, Dr. Albert Narath, *Kino-technik* 15: 3-7, Jan. 1961.

Guided by the development of cinematography, the author outlines the history of the Deutsche Kinotechnische Gesellschaft which was established 40 years ago. Four periods of nine years each may be distinguished as the characteristic phases in cine film development. These are the silent film era (1920-1929), the sound film era (1929-1938), the color film era (1938-1947), and the era of magnetic-tape and wide-screen methods which lasted from 1947 to 1956. This is followed by a period characterized by the introduction of electronic devices into the cine art, the development of magnetic image recording and the partial adoption of means and methods originally devised for TV. This subdivision is adhered to also in outlining the history of the Deutsche Kinotechnische Gesellschaft.

GENERAL

Piezoelectric Ceramic Transformers and Filters, Alan E. Crawford, *Jour. Brit. IRE*, 27: 353-360, Apr. 1961.

The development of improved piezoelectric ceramics has enabled these materials to be used in the design of electronic components. Two new devices are described embodying piezoelectric principles of operation and relying on electromechanical resonance to obtain efficient energy transformation. The ceramic transformer provides a high voltage source without involving insulation problems or magnetic fields. The Transfilter is used as a miniature filter or an interstage impedance matching transformer suitable for radio receivers. Both are essentially solid-state in character and possess all the advantages of such systems. They present an entirely new approach to component development and can be considered as forerunners of other devices using similar principles.

HIGH-SPEED PHOTOGRAPHY AND INSTRUMENTATION

The Determination of the Accuracy of Quantitative Interpretation of a Motion-Picture Film (in Russian), A. A. Kukibnyl, *Zhur. Nauch. i Priklad. Fotografii i Kinomatografii*, 6: No. 2, 102-07, Mar.-Apr. 1961.

In the quantitative interpretation of the frames of a motion-picture film it is not

Complete 16mm Laboratory

FAST QUALITY SERVICE

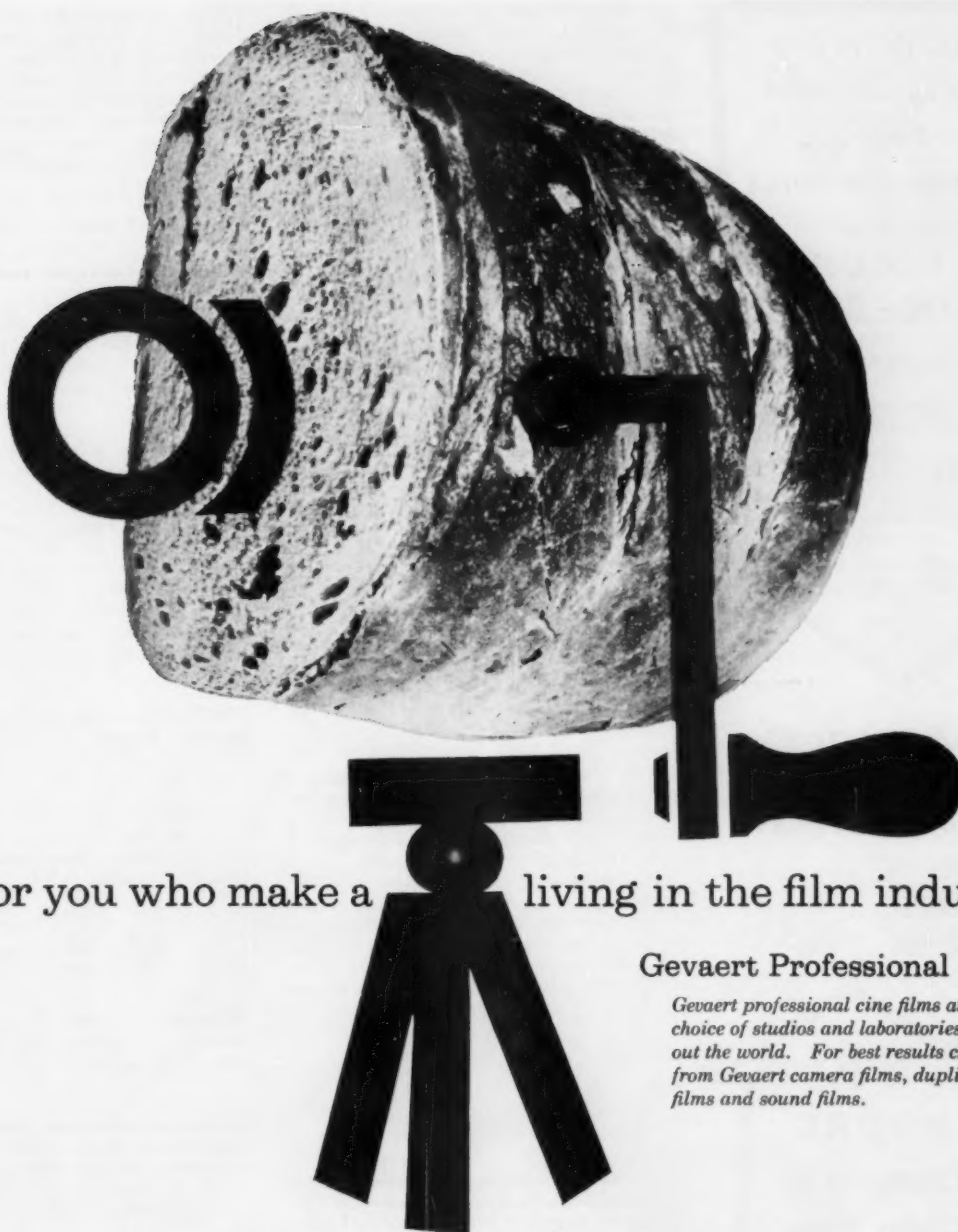
Negative or Reversal Processing
Color Duplicating
Black-and-White Duplicating
Editing
Sound Recording
Titling
Animation

Write for Price Schedules



Par-American Films

735 POYDRAS STREET, NEW ORLEANS, LA., JACKSON 2-5364



For you who make a living in the film industry

Gevaert Professional Films

Gevaert professional cine films are the choice of studios and laboratories throughout the world. For best results choose from Gevaert camera films, duplicating films and sound films.

POSITIVE FILMS

2 Gevaert films which you must definitely try soon: Positive Fine Grain, because of its exceptional fine grain; Positive Super Contrast, for its heavy black and transparent white.

Negative Films

Duplicating Films

Sound Films

Gevacolor Color Films

Reversal Films

Magnetic Films

Television Films

GEVAERT

offers a complete line of quality photographic materials

GEVAERT PHOTO-PRODUCTEN N.V., 27 SEPTESTAAT, MORTSEL (ANTWERP) BELGIUM

In the U.S.: The Gevaert Company of America, Inc., 321 West 54 Street, New York 19

In Canada: Photo Importing Agencies Ltd., 345 Adelaide Street, Toronto 2B, Ontario

**NOW...for
Ektachrome
users...**

ONE-DAY SERVICE

on 16 mm

**COLOR
PROCESSING**

Licensed by Kodak

EKTACHROME 5¢ ft.

EKTACHROME 6¢ ft.

Chemical and
sensitometric
controls to rigid
Kodak standards.

**TEXAS INDUSTRIAL
FILM COMPANY**



2528 NORTH BLVD.
JA 9-4377

HOUSTON

**48
HOURS
Camera to
Color Print**

Let us process your
Ektachrome camera
film, assemble it,
make a
COLOR (11¢)
B & W (6¢)
print with printed edge
numbers, then ship to you
within 48 hours after
receipt of your original.

Write for
complete laboratory
price list.

possible to avoid the smoothing out of the calculated results in space and time, nor errors in observation of the magnitude being measured. By an analytical mathematical method, an estimation can be made of the accuracy of the results of calculation of magnitudes depending on the assumed smoothing out in time and space, and errors of observation of linear magnitudes.

The length of the time interval taken for averaging has an influence on the accuracy of the treatment of the results of the investigation: the smaller the period of averaging, the higher the accuracy of the calculation of the magnitudes to be determined.

Errors due to smoothing-out in space are reduced in the case in which the sighting plane is a plane of symmetry of the motions of the bodies, and the planes of their motions are not significantly inclined to the sighting plane of the objective of the motion-picture camera.—S.C.G. (Translation of Author's Abstract.)

PRINTING AND OPTICS

The Transmission of an Image by a Multichannel Light Conductor (Fiber Optics) (in Russian), V. B. Veinberg, V. V. Bogatyreva and L. N. Evanova, *Optiko-Mekh. Prom.*, No. 7, 23-30, 1960; *Tekh. Kino i Televideniya*, 5: 90, Feb. 1961.

A description is given of the principles of multichannel light-conducting elements, some of the results obtained with them are shown and possible schemes for the application of fiber elements are discussed.

The following points are considered: the light transmission of a glass rod and fiber; the transmission of an image through a bundle of fibers; the preparation of light-conducting fibers; flexible fiber bundles; special interlacing and packing of the fibers. A bibliography of 73 references is given. (Translated from *Tekh. Kino i Televideniya*)

PROJECTION

Objective Distortions of Cinematograph Images with Vertical and Horizontal Projection Angles II. The Cylindrical Screen (in Russian), E. M. Goldovskii and S. S. Ryshkov, *Zhur. Nauch. i Priklad. Fotografii i Kinematografii*, 6: No. 1, 53-60, Jan.-Feb. 1961.

The mathematical analysis of distortions introduced into the projected picture by the angle of projection, carried out for a flat screen in Part I (*Zhur. Nauch. i Priklad. Fotografii i Kinematografii*, 5: No. 6, 439-445, Nov.-Dec. 1960), is here extended to the case of the cylindrical screen.

An All-Purpose Motion-Picture Projector for Large-Capacity Cinemas (in Russian), A. N. Karal'nik, *Tekh. Kino i Televideniya*, 5: 31-43, Jan. 1961.

A detailed description is given of the Soviet TKPU-1 motion-picture projector

which is intended for the screening of 35mm films with optical soundtrack and aspect ratio 1.38:1; wide-screen 35mm films with 4-channel magnetic soundtracks and aspect ratio 2.55:1; wide-screen 35mm films with a single optical soundtrack; and 70mm films with stereophonic sound on six magnetic soundtracks.

Czechoslovak Motion-Picture Projectors (in Russian), J. Stanek, *Tekh. Kino i Televideniya*, 5: 74-79, Jan. 1961.

Two Czechoslovak 35mm projectors for cinema use are described. The Meopton-IV is intended for small to medium halls, while the FTP-1 is a more powerful projector for large halls.

Curved Film Gates (in Russian), A. Karal'nik, *Kinomekhanik*, 33-35, Mar. 1961.

A number of reasons are given for preferring a curved gate to a straight one in a motion-picture projector, including the tendency of the film to curve and the curvature of the focal plane of the projector objective. The construction of curved gates is discussed, and Soviet-made projectors which have them are mentioned.—S.C.G.

The Problem of Screen Shape in Large-Capacity Cinemas (in Russian), E. M. Goldovskii, *Tekh. Kino i Televideniya*, 5: 40-44, Mar. 1961.

The design of screens for the exhibition of panoramic and wide-screen films in theaters with seating capacities of 1000-6000 places is discussed.—S.C.G.

SOUND RECORDING AND REPRODUCTION

When the Wide Screen Bursts Forth with Sound, L. Trakhtenberg, *Isk. Kino*, 98-101, No. 3, Mar. 1961.

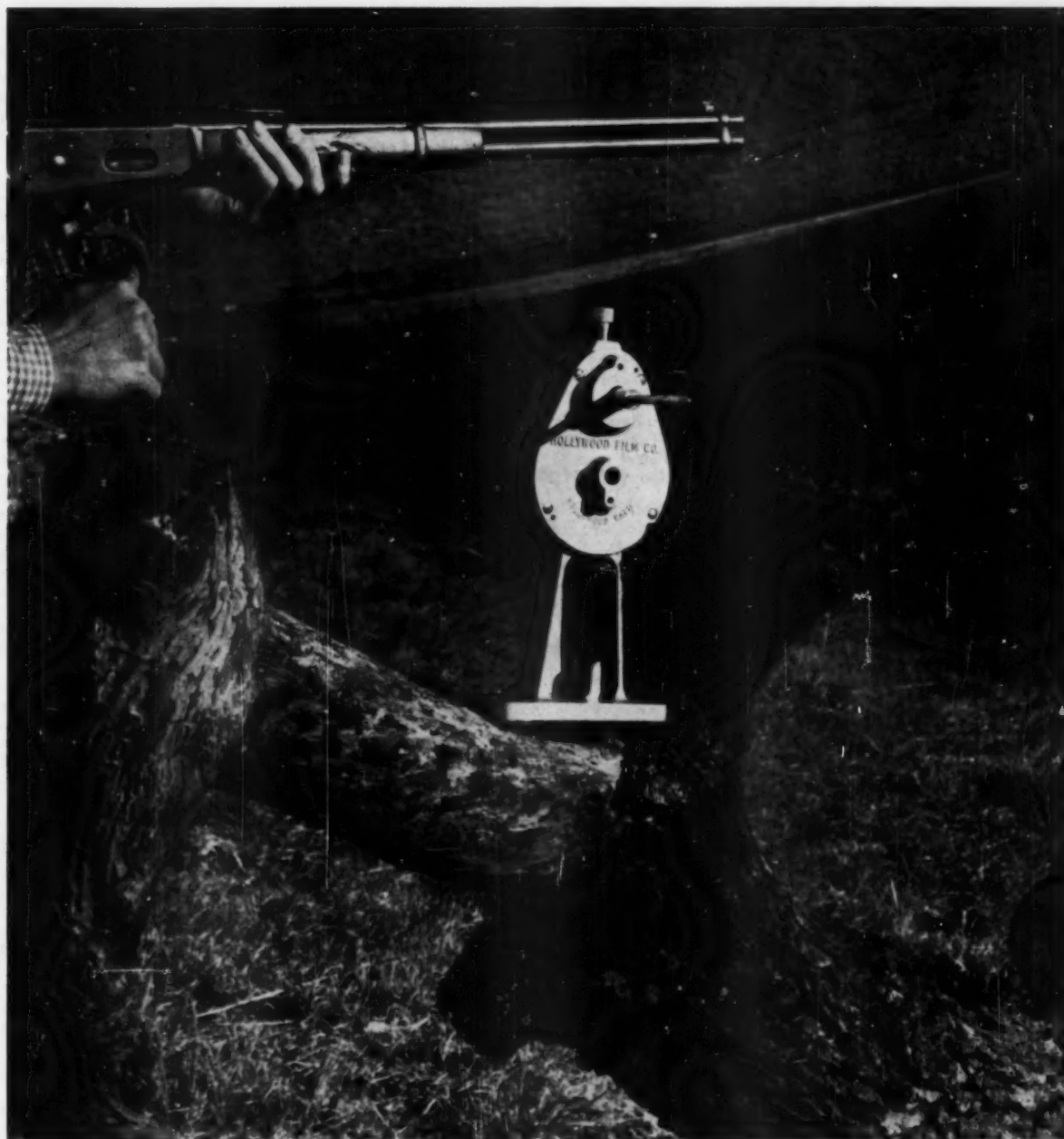
Apparatus for Reproduction of Magnetic Soundtracks from Three Films Synchronized with the Picture (in Russian), M. F. Ottochek and R. I. Glikzon, *Tekh. Kino i Televideniya*, 5: 62, Jan. 1961.

The Kiev motion-picture studios have produced an apparatus for playing three soundtracks simultaneously in synchronism with a picture. It is intended for editing, montage and similar purposes.

Taking of Motion Pictures at Processes of Modification in the Magnetic Structure of Thin Ferromagnetic Films in a Magnetic Field, L. V. Kirenskii, V. A. Buravikhin and M. K. Savchenko, *Fiz. Metallov i Metalloved.*, 11: 529, 1961.

Optical Reduction of Soundtracks from 35mm Negative onto 16mm Prints (in Russian), S. D. Karipidi, *Tekh. Kino i Televideniya*, 5: 49-53, Mar. 1961.

Soviet motion-picture printers for the optical reduction of 35mm sound originals



Every part precision built...

Precision in manufacture and precision in operation, is the HFC Professional Hand Rewind. Three separate models are available; RE (for normal winding), REF (with a top friction control to retard the pull on the film) and REL (with the elbow brake used for film inspection). The gears are precision cut w/4:1 ratio, also w/2½:1 ratio on special order.

A method of interchanging the film shafts in the rewind can be accomplished in a few seconds, thus making the HFC rewind one that can handle any number of reels by inserting a stock shaft without the necessity of removing the rewind from the editing table.



HOLLYWOOD FILM COMPANY

designers & manufacturers of film & video tape editing equipment

WRITE FOR FREE CATALOG:

956 SEWARD ST, HOLLYWOOD 38, CALIF. HO 2-3284

524 W. 43rd ST, N.Y., N.Y., LO 3-1546

onto 16mm film use a spherical lens instead of the cylindrical lens used elsewhere, and print two of the reduced tracks in parallel. The frequency response and nonlinear distortions of the system are discussed, and recommendations are made for the preparation of soundtracks on 35mm originals intended for reduction to 16mm.—S.C.G.

The Standardization of Magnetic Sound Recording in Amateur Films (in Russian), S. D. Karipidi and L. A. Novgorodtseva, *Tekh. Kino i Televideniya*, 5: 68-70, Jan. 1961.

The NIKFI Laboratories have worked out a standard for 8mm and 16mm films with magnetic soundtrack, specifying the width and position of the tracks and the position of the playback head. It came into effect on Jan. 1, 1961 as GOST 9492-60. The main provisions of the standard are set out and commented upon.

The New Types of Cinematography (in Russian), M. Z. Vysotski, *Tekh. Kino i Televideniya*, 5: 13-20, Jan. 1961.

The difficulty of installing four-channel stereophonic sound in cinemas has meant that, in the West as well as in the Soviet Union, a large number of cinemas are still without this type of system. Consequently there are two standards for wide-screen film, one with four magnetic soundtracks and a picture 23.16mm wide, and the other with a single photographic soundtrack and

a 21.3mm picture. This causes difficulties, as a film must usually be printed on both kinds of stock. The U.S.S.R. would like to see the adoption of a single, universal film, carrying simultaneously the four magnetic tracks and one photographic track. The smaller perforation at present used with the magnetic tracks is preferred.

Problems of "squeezing" and "unsqueezing" in anamorphic systems and points arising in 70mm cinematography are discussed.

Finally, the author advocates the use of 70mm film together with an anamorphic system with a coefficient of 1.25-1.3. Such a system is versatile and in addition to being used "straight" can be used with other systems, e.g., three positives for Cinerama-type projection can be made from one "squeezed" 70mm negative.

An Equipment for Automatically Processing Time Multiplexed Telemetry Data, N. Purnell and T. T. Walters, *Jour. Brit. IRE*, 21: 257-274, Mar. 1961.

An equipment is described for processing magnetic tape recordings of frequency-modulated time-multiplexed telemetry data. Details are given of the way in which the input signals are derived and the method by which the recordings are made. The equipment produces two forms of output: analogue graphs on paper film and digital records on punched cards. The performance achieved and the methods of checking this performance are detailed.

TELEVISION

Apparatus for Automatic Examination of Nuclear Photographic Emulsions by the Television Raster Method. Follow-up System, A. E. Voronkov, A. I. Galaktionov, I. D. Murin and L. V. Sukhov, *Pribory i Tekh. Eksp.*, 6: No. 2, 63-86, 1961.

The Aperture Properties of a Motion-Picture Image and Their Influence on the Television Image (in Russian), Z. Novak, *Tekh. Kino i Televideniya*, 5: 20-26, Mar. 1961.

From a selection of 35mm films of suitable subjects, an average curve showing transmission plotted against distance was constructed for the transition across an edge formed by two adjacent densities with a density difference of 1.5. From this an equivalent aperture function was deduced for a motion-picture image. The aperture properties of the motion-picture film in the horizontal direction can be replaced by the characteristics of an equivalent electric circuit, the transition curve with distance being replaced by one with time. It is concluded that the detail rendering of a motion-picture film is poorer than that of a direct television picture. When a film is used as an intermediate stage in a television broadcast, the situation can be improved by aperture correction, the best form of which is discussed.—S.C.G.

The Correction of Color Distortions in a Color Television Image on the Transmission of Motion-Picture Films (in Russian), V. M. Zusmanovich and A. G. Buryakov, *Tekh. Kino i Televideniya*, 5: 33-39, Mar. 1961.

There are two main causes of color distortion when color films are televised: the difference in brightness range of a film compared with a directly televised subject, and, more important, the defective color gradation and separation in the film itself. Electronic masking to compensate for these factors is discussed.—S.C.G.

Concerning the Density of the Recording of Wideband Signals, I. E. Gordon and Iu. P. Drobyshchev, *Radiotekhnika*, No. 16: 59-66, 1, Jan. 1961.

Methods of Recording Color Television Programs on Film (in Russian), A. A. Gol'din, *Tekh. Kino i Televideniya*, 5: 21-25, Jan. 1961.

Outlines are given of the Eastman Kodak lenticular-film method of recording color-television programs, and of the system described by Hughes of the Iowa State College. The author's own system (known as LEIS, from the initials of the Leningrad Electromechanical Institute for Communications) is then described. In this a coding unit converts the signals of the three color channels into a brightness signal and two color-difference signals (e.g., R-Y, B-Y), which are recorded on standard black-and-white film by means of ordinary telecine equipment, and are reproduced, in a similar manner, with ordinary telecine equipment and a decoding unit which feeds the reconstituted R, G, and B signals to the channels.

ELECTROACOUSTICAL ENGINEER (California)

Opportunity for interesting accomplishments in a new field of application for your unique background and ability. A new key position open in R&D group which leads its industry with prosperous, famous, stable, AAAA, Los Angeles manufacturer.

Our recognition of the value of focusing sophisticated talents upon new product areas is reflected in our steady and impressive growth, with no government work.

We are looking for an Electroacoustical Engineer with practical experience in the design of mechanical sound generators and sound reproducers, including supporting experimental measurement of acoustic parameters. Experience in experimental phonographic disc recording would be welcome, as would design work with loudspeakers and underwater sound transducers.

Generous salary and benefits in accord with background, and the special satisfaction of actually seeing the end products of your work nationally recognized.

Our employees know of this ad.

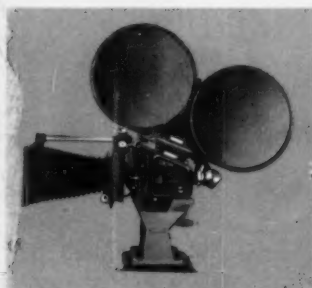
Please send confidential resume of professional background to
Box A-11, SMPTE, 55 West 42 St., New York 36, N. Y.

ASSURANCES PROFESSIONAL FILM MAKERS DEMAND!

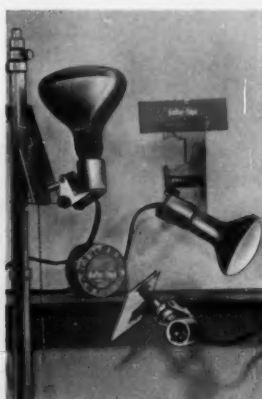
1 THE
MANUFACTURER'S
LABEL

2 CECO'S*
GUARANTEED
INSPECTION AND
STAMP OF APPROVAL

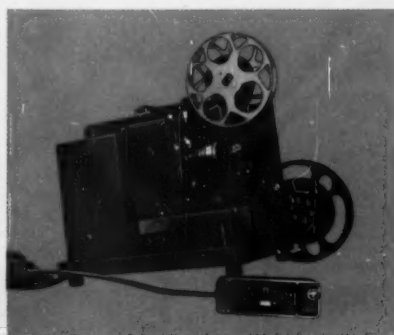
Producers, directors, cameramen, photo-instrumentation and audio-visual engineers come to us for products, equipment repairs, information and ideas because of our know-how and experience as pioneers in the photographic industry. Our staff of engineers and technicians learned on the firing line of practical application.



New CECO 1000 foot Magazine for Arriflex 35mm



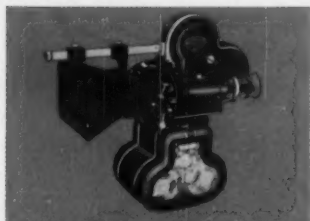
LOWEL-LITE Kit with Gaffer Tape
(A lighting unit which attaches to walls, shelves, stands, pipes... most anywhere)



New CECO Advanced Weinberg-Watson Remote Control 16mm Stop Motion Projector (absolutely flickerless). Also CECO 35mm Stop Motion Projectors.



JARO-Salford Professional Light Exposure Meter with Carrying Case



New NOMAD Synchronous Transistorized Sound Recorder/Reproducer
(Lightweight—completely portable)

For full
information
and price
of each
product,
send this
postage-free
card now!!!

*CECO — Trademark of
Camera Equipment CO., Inc.

CAMERA EQUIPMENT CO., INC.

315 West 43rd St., New York 36, N. Y.
JUdson 6-1420

Gentlemen: I am interested in the items checked below.
Please rush me more free information on these products

- | | |
|--|---|
| <input type="checkbox"/> CECO 1000' Magazine for Arri 35 | <input type="checkbox"/> Editing Gloves and Supplies |
| <input type="checkbox"/> NOMAD Sound Recorder/Reproducer | <input type="checkbox"/> MOVISCOP 16mm Film Viewer |
| <input type="checkbox"/> JARO-Salford Light Meter | <input type="checkbox"/> CECO Portable Power Supply |
| <input type="checkbox"/> CECO Weinberg-Watson Projector | <input type="checkbox"/> JEFRONA Cement—GTC-9 Cleaner |
| <input type="checkbox"/> LOWEL-LITE Kit | <input type="checkbox"/> PRECISION Sound Readers |
| <input type="checkbox"/> PROSKAR Anamorphic Lens | <input type="checkbox"/> CECO Film Cleaning Machine |
| <input type="checkbox"/> COLORTAN Lighting Equipment | <input type="checkbox"/> COLORTAN Polecats |

Name _____ Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

**BEFORE DECIDING TO BUY, RENT, LEASE OR REPAIR YOUR EQUIPMENT,
CHECK WITH CECO. ADVICE FROM CECO MEANS MONEY IN YOUR POCKET.**

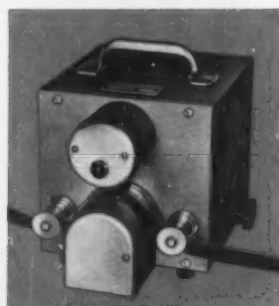
Editing Gloves and Cutting
Room Supplies



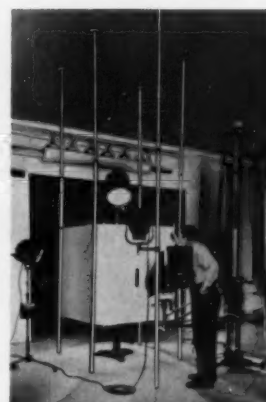
We provide the same
precision repair service for
your equipment that we
give to our own gigantic stock
of rental cameras, editing,
lighting and other equipment.



MOVISCOP 16mm Film Viewer



PRECISION Sound Readers
(3 models — Optical, Magnetic,
Optical-Magnetic combined)



COLORTAN Polecats
(telescoping columns) for
Attaching Equipment, Lights, etc.
(Various heights available)



New CECO Portable Power Supply for
Auricon Cine-Voice Camera



New CECO Film Cleaner
and Cleaning machine



PROSKAR Projection and Photo-
graphing Anamorphic Lens for
16mm Cameras and Projectors



COLORTAN Lighting Kits and Equipment



FIRST CLASS
PERMIT No. 4236
New York, N. Y.
Sec. 34.9, P. L. & R.

BUSINESS REPLY MAIL

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY

CAMERA EQUIPMENT COMPANY, INC.

DEPT. 63, 315 WEST 43RD STREET

NEW YORK 36, N. Y.

In New York:
Camera Equipment Co., Inc.
315 W. 43rd St.
New York 36, N. Y.
Judson 6-1420

In Florida:
Camera Equipment Co., Inc.
of Florida, 1335 E. 10th Ave.
Hialeah, Florida
TUxedo 8-4604

In Hollywood, California:
Camera Equipment Co., Inc.
6510 Santa Monica Blvd.
Hollywood, California
HOLlywood 9-5119



JEFROMA Film Cement &
GTC-59 Lens Cleaner

Transfer Character Between Color Film and Tricolor CRT, H. Genta, S. Kubo, S. Ohe, and T. Sakaguchi, *Chiba Daigaku Kogakubu Kenkyū Hōkoku*, 11: No. 19, 1-19, 1960.

Transfer character from color film to tricolor CRT in the color television system of National Television system Committee was studied. A large amount of undesirable spectral absorption by the dyes employed for color film may affect the transfer gradient and color reproduction qualities. Both experimental and theoretical results on relations between color film images and tricolor CRT images are described for the color printing type positive film and NTSC color television monitor set.

The Standardization of International Microwave Radio-Relay Systems, W. J. Bray, *Proc. Inst. Electrical Engineers*, 108: Pt B, 180-200, Mar. 1961.

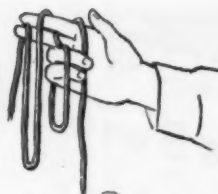
Microwave radio-relay systems using line-of-sight paths now form a substantial part of the international trunk network, both for multichannel telephony and for television. In order that such systems shall provide satisfactory transmission over long distances they must conform with certain minimum performance standards. Furthermore, in order to facilitate the interconnection of radio-relay systems with one another and with line systems, certain common characteristics are necessary. The establishment of links across national frontiers also requires the use of equipment with similar characteristics in each country.

The paper outlines the work of the International Radio Consultative Committee (C.C.I.R.) and the International Telegraph and Telephone Consultative Committee (C.C.I.T.T.) in defining preferred characteristics for microwave radio-relay systems using line-of-sight paths, and discusses the technical and other reasons for the particular values adopted. The need for preferred characteristics for radio-relay systems using tropospheric-scatter propagation is also referred to.

Tables of Horizontal Radiation Patterns of Dipoles Mounted on Cylinders, P. Knight and R. E. Davies, *BBC Engineering Div. Monograph*, No. 35: 5-6, Feb. 1961.

This monograph contains tables of the horizontal radiation pattern (h.r.p.) of a dipole mounted on a cylindrical mast. The tables were calculated on a digital computer and this enabled a comprehensive range of mast sizes and dipole spacings to be covered. The tables of h.r.p.s. should satisfy most requirements arising in the design of vhf. aerial systems for broadcast transmitters. Although applicable to cylindrical masts, they may be used with little error for masts of square or triangular cross-section provided the widths of the mast faces do not exceed 0.5λ and 0.3λ respectively. The tables are intended not merely to give the pattern of a single dipole but also to simplify the calculation of the patterns of arrangements of more than one dipole spaced around a mast; this is achieved by appropriate addition of the contributions of each dipole and an analogue computer has been developed in the BBC Research Department to facilitate this operation.

LIMP as a string!



QUIET as a tomb!



LENZ



MICROPHONE BOOM CABLE

Flexibility is one of the first requirements of a microphone cable—particularly when it is used on a mike boom. Lenz Microphone Boom Cable offers you the maximum in flexibility—it's as limp as a piece of twine!

Along with its extreme flexibility, it is quiet! Twist it into a knot, there's not the slightest noise to mar the sound track.

Because it is designed for the job, this is the perfect mike cable.

Made in 3 to 7 conductor types to suit any mike.

Lenz also manufactures "Multiplex" Double Channel Audio Cable for stereo broadcast receivers, Hyanode High Voltage Lead Wire, Cables for Public Address Systems and other similar cables for special applications.

Write today for complete details and sample of Lenz Microphone Boom Cable.



CABLES

and

WIRES

LENZ ELECTRIC MANUFACTURING CO. 1753 No. Western Ave., Chicago 47, Illinois
IN BUSINESS SINCE 1904



More and more Purchasing Agents are discovering that a bid from Florman & Babb means lowest prices, fast delivery, reliable equipment and unexcelled service! One bid request covers any/all large/small items because F & B can deliver everything for making motion pictures from their vast stocks.

Put us on your mailing list... and let us put you on ours!
FREE catalogs, specifications, and information.

Serving the World's Finest Film Makers

FLORMAN & BABB, Inc.

68 W. 45th St., New York 36, N. Y.

Murray Hill 2-2928

Another Fine Product From ACMADE
AUTOMATIC BUTT SPLICER
Cuts, Slices, Applies Magic Mylar Automatically



Now, with no fuss, mess or waste, it is possible to splice, repair, butt-splice, or strengthen splices on all types of film—positive, negative, magnetic—even duPont Cronar or other bases.

The cutting arm, shown in operating position, is used by pressing the chrome button for cutting both sides of the film simultaneously. The film has been registered on pins in the horizontal channel. The cutting blade is easily replaced.



The splicing tape is registered on precision pins and held in place until automatically applied to the film by swinging the arm over and pressing the chrome button, cutting the adhesive and applying it—in perfect register to the film.

Model 35 for 35mm, Model 16 for 16mm—\$295

Serving the World's Finest Film Makers

FLORMAN & BABB, Inc.

68 W. 45th St., New York 36, N. Y.

Murray Hill 2-2928

New Members

The following members have been added to the Society's rolls since the April 1960 *Directory* and those listed in numerous subsequent *Journals*. Also listed are those regretfully reported as deceased since the listing. The designations of grades are the same as those used in the *Directory*. An up-to-date list of the Sustaining Members appears on the outside back cover of each month's *Journal*.

Fellow (F) Active (M) Associate (A) Student (S)

Deceased:

Claude C. Baldridge (A)	O. B. Hanson (F)	Harry Peterson (M)
Robert P. Burns (M)	Kenneth P. Herrick (A)	Monroe H. Sweet (M)
Bernard W. Cruger (M)	George Klymshyn (A)	Val C. Zurek, Sr. (A)
Hugh H. Gwynne (M)	Sidney M. Lipton (A)	

Acquisto, Ernest, Broadcast TV Eng., USIA. Mail: 2757 S. Glebe Rd., Arlington 6, Va. (A)

Allen, Robert, Sound Mixer, Robert Allen (Sound) Ltd. 12 Ashby Grove, London N. 1, Eng. (A)

Anderson, Todd Gilbert, Allen Hall, Brigham Young University, Provo, Utah. (S)

Anthony, James K., Film Processor. Mail: 8411 New Hampshire Ave., Hyattsville, Md. (A)

Bailey, Lem, Producer Film Library, Lem Bailey Productions, 7934 Santa Monica Blvd., Hollywood 46, (A)

Barr, J. W., Mot.-Pic. Prods. Asst., Univ. Illinois. Mail: 312 W. White, Champaign, Ill. (A)

Bauer, Charles J. Jr., Mot.-Pic. Cutting, Editing, Haycox Photomatic, Inc. Mail: 5365 Hanyen Dr., Norfolk 2, Va. (A)

Beard, Robert L., Sr. Photo Techn., Engrg. Staff, Ford Motor Co. Mail: 22239 Samuel St., Taylor, Mich. (A)

Beckett, Roland, Film Producer, Shell Film Unit. Mail: 102-10 Wyldie St., Potts Point, Sydney, Australia. (A)

Berchtold, Jean, Sr. Research Physicist, Bell & Howell Research Center, 360 Sierra Madre Villa, Pasadena, Calif. (M)

Berliner, David, Supv., Qual. Contr. Specialist, Military General Supply Agency, Richmond Quartermaster Depot. Mail: 3416 Grove Ave., Richmond 21, Va. (A)

Berman, Erwin L., Sales Eng., Cooper-Simon & Co. Mail: 94-30 59 Ave., Elmhurst 73, N.Y. (A)

Berry, Jacques H., Cons. Eng., John E. Wahl Co. Mail: 5509 S. Hyde Park Blvd., Chicago 37, (A)

Bethencourt, Frank X., Neg. Devel. Foreman, Control, M-G-M Labs. Mail: 8900 Enfield Ave., Northridge, Calif. (A)

Black, George R., Mgr. Field Service & Training, GPL Div., General Precision Inc. Mail: Bullet Hole Rd., Mahopac, N.Y. (M)

Bledsoe, Bruce A., Stripping Foreman, M-G-M Studios. Mail: 417 N. Oakhurst Dr., Apt. 1, Beverly Hills, Calif. (A)

Bliss, James E., D.D.S., Camarillo State Hospital, Box A, Camarillo, Calif. (M)

Blouch, Donald H., Electr. Eng., General Kinetics Inc. Mail: 521 Tennessee Ave., Alexandria, Va. (A)

Boolsky-Bogopolsky, Raphael, Cons. Physicist, 10 Av. de Miremont, Geneva, Switzerland. (M)

Borniche, Elwood A., Neg. Foreman, M-G-M Labs. Mail: 11020 Freeman Ave., Inglewood 2, Calif. (A)

Boyke, Roy, Cinemat., Govt. of Trinidad & Tobago. Mail: Trinidad Film Unit, Film Centre, St. James, Trinidad, B.W.I. (A)

Bresnick, Herbert L., Electr. Eng., Itek Labs. Mail: 44 Pole Plain Rd., Sharon, Mass. (M)

Brodie, James T., Sales Mgr., O'Connor Engineering Laboratories, 9862 Highland Ave., Alta Loma, Calif. (A)

Camford, Robert, Special Film Advisor, CBS News, 420 Lexington Ave., New York. (A)

Camus, John, Sr. Member, Tech. Staff, Internatl. Tel. & Tel. Corp. Mail: 5948 Hazeltine Ave., Van Nuys, Calif. (M)

Cardoso, Manuel Rodrigues P., Telecommunication, Televisao Tupi, Sumarc. Mail: Rua Conselheiro Furtado, 827, Apt. 1302, Sao Paulo, S.P., Brazil. (A)

Carlile, Frederick E., Supvr., Flight Test Photog., General Dynamics—Ft. Worth, Fort Worth 1, Tex. (M)

Carter, William D., Asst. Eng., Consolidated Film Ind. Mail: 2121 Kress St., Los Angeles 46, (A)

Caudle, Howard P., Project Eng., Eastman Kodak Co. Mail: 490 Holt Rd., Webster, N.Y. (A)

Cepparo, Renato, Owner, Record Film. Mail: Via Leonida Bisolati 22, Milano, Italy. (A)

Chalmers, Phillip C., Mot.-Pic. Writer, Radio Corp. of America. Mail: 2115 Fernbrook Dr., Huntsville, Ala. (A)

Chamness, Lee C., Photo Equip. Sales, Natural Lighting Corp. Mail: Box 4397, Washington 12, D.C. (A)

Chatterjee, Atul, Sound Eng., Studio Supply Co.-Op. Society, Ltd. Mail: 12, Prince Anwar Saha Rd., Tollygunge, Calcutta 33, India. (A)

Cobb, Gerald A., Timer, Printer, Mot.-Pic. Lab. Techn., Sandia Corp. Mail: 8110 Robin Ave., N.E., Albuquerque, N.M. (A)

Colman, Samuel, Cameraman, M-G-M Studios. Mail: 417 N. Orange Dr., Los Angeles 36, (M)

Comer, Boyd B., Mot.-Pic. Film Co-ord., RCA Service Co. Mail: 4103 Cloverdale Dr., Huntsville, Ala. (A)

Cook, Dean C., Chief Eng., Radio-TV Dept., Board of Education. Mail: 16204 Prairie Ave., Detroit 21, (M)

Cooke, Terence B., Supvr., Film Sound Dept., Baton, Aldred Rogers Broadcasting Ltd. Mail: 38 Thorncliffe Park Dr., Apt. 411, Toronto, Ont., Can. (A)

Cox, Calvin Gene, Negative Cutter, RCA Service Co. Mail: 528 Adams St., S.E., Huntsville, Ala. (A)

Crane, Michael O., Asst. Plant Eng., Pathe Labs. Mail: 11220 Valley Spring La., N. Hollywood. (M)

Crews, Capt. Howard W., USN, U.S. Naval Photographic Center, NAS, Anacostia 25, D.C. (M)

Cala, John Zoltan, TV Design Eng., Conrac Div., Giannini Controls Corp. 1535 W. San Bernardino Rd., Bldg. 2, Apt. N, W. Covina, Calif. (M)

Davidoff, Frank, Project Eng., CBS-TV Network. Mail: 69 Coventry Garden, Lynbrook, N.Y. (M)

De Josephim, Sunny, Sr. Cinema Projectionist, Federal Ministry of Information. Mail: 11, Oke-Suna St., Lagos, Nigeria, W. Africa. (A)

Dennis, Charles O., Slidefilm Animation, Producers Color Service, Inc. Mail: 22424 Avalon, St. Clair Shores, Mich. (M)

Downes, John G. McKenzie, Cons. Electr. Eng., Via A. Bertoloni 31, Rome, Italy. (M)

Dzickowski, Ronald, Cine Cameraman & Editor, Haycox Photomatic, Inc. Mail: 1531 Early St., Norfolk 2, Va. (A)

Egliseder, Theodor, Techn., Movie Cameras, Braun of Canada. Mail: 122 Fifth St., Apt. 3, Toronto 14, Ont., Can. (A)

Elbridge, Donald F., Vice-Pres. & Tech. Dir., Memorex Corporation 2000 El Camino Real, Mountain View, Calif. (M)

Epperson, Robert D., Tech. Cinefluorography & CCTV, Univ. Penn. Mail: 421 E. Gewen Ave. Philadelphia 19, (A)

Fagan, Isadore, Neg. Timer, Film Techn., M-G-M Labs. Mail: 9339 Loyola Blvd., Los Angeles 45, (A)

Farris, Robert L., Vice-Pres., Recording, Futursonic Prods. Mail: 1718 Glenbrook Dr., Irving, Tex. (M)

Fayd, John Jacques, Don Martin Sch. Radio & TV Arts. Mail: 1024 E. Elden Ave., Los Angeles 6, (S)

Fields, Thomas Gibson, Univ. So. Calif. Mail: Box 1065, Hollywood 28, (S)

Findlay, William D., Vice-Pres., Behrend Cine Corp. Mail: 391 Turner Ave., Glen Ellyn, Ill. (A)

Foster, Hugh C., TV Prodn., U.S. Information Agency, TV Service, Washington 25, D.C. (A)

Friedman, Nathan P., Chief Eng., Tape Processing Center, Univ. Purdue. Mail: 2601 Union St., Lafayette, Ind. (M)

Galanty, Sidney, TV Prod.-Dir., USIA. Mail: 3200 Toledo Pl., Apt. 2, W. Hyattsville, Md. (A)

Galluzzi, Paul, Electr. Eng., Itek Labs. Mail: 10 Peabody Ave., Beverly, Mass. (A)

Garbers, Leon Thomas, Univ. So. Calif. Mail: R.D. 1, Napoleon, Ohio. (S)

Gardener, Herbert M., TV Eng., CBS-TV. Mail: 33 Wendy Rd., Colonia, N.J. (A)



MAGNASYNAC
LIMESTONE
MAGNETIC FILM RECORDING

Magnaphonic
SOUND SYSTEM

Named MARK I



Basic System \$675.

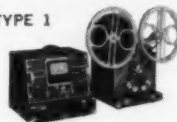


From \$985.



X-400

From \$985.



TYPE 1

From \$1430.



TYPE 15

From \$1385.



TYPE 5

From \$1650.



MARK IX

From \$2145.

Write, wire or phone
MAGNASYNC
CORPORATION

Authorized Dealers

CHICAGO, ILL.
Behrend Cine Corp.
161 E. Grand, MI 2-2281
Zenith Cinema Service, Inc.
3252 Foster, IR 8-2104
DAYTON, OHIO
Salem Camera Co.
335 Salem, BA 3-7206
DENVER, COL.
Western Cine Service, Inc.
312 S. Pearl, SH 4-1017
HIALEAH, FLA.
Camera Equipment Co., Inc.
51 E. 10th, TU 8-4064
HOLLYWOOD, CALIF.
Birns & Sargent Cine Equipment
6424 Santa Monica, HO 4-5166
Camera Equipment Co., Inc.
6510 Santa Monica, HO 9-5119
S.O.S. Photo-Cine-Optics, Inc.
6331 Hollywood, HO 7-9202
KANSAS CITY, MO.
Barnard's, 4724 Broadway.
Country Club Plaza, LO 1-7761
Crick's Camera Shop
6320 Brookside Plaza, HI 4-3390
MINNEAPOLIS, MINN.
Century Camera Shops, Inc.
26 S. 7th, FE 8-5857
NEW YORK CITY
Camera Equipment Co., Inc.
315 W. 43rd, JU 6-1420
Florman & Babb, Inc.
68 W. 45th, MU 2-2928
Pictronics Corporation
236 E. 46th, YU 6-3713
S.O.S. Photo-Cine-Optics, Inc.
602 W. 52nd, PL 7-0440
PHOENIX, ARIZ.
Wilson Camera Sales Co.
130 W. Adams, AL 4-0662
ST. LOUIS, MO.
Stanley Photo Service
106 N. Broadway, CE 1-7840
SAN FRANCISCO, CALIF.
Brooks Cameras, Inc.
45 Kearny, EX 2-1902
SAN MATEO, CALIF.
Foreman's
121 Fourth Ave., DI 3-1869
SOUTH AFRICA
Photo Agencies Pty. Ltd.
9 Kerk St., Johannesburg
AUSTRALIA, Sydney
Sixteen Millimeter
Australia Pty. Ltd.
49 Market, New South Wales
BOLIVIA, La Paz
Casa Kavin
Casilla 500, Calle Potusi 261-263
BRAZIL, Rio de Janeiro
Mesbla, S.A.
Rua do Passeio 42/56
BURMA, Rangoon
G.K. Theatre Supply Co., Ltd.
123 Sule Pagoda Road
CANADA, Islington, Ontario
Alex L. Clark, Ltd.
3751 Bloor St., W.
DENMARK, Copenhagen
CHL Kinovox Electric Corp.
Jenslovvej 2
ENGLAND, London
Delane Lea Processes, Ltd.
12 Moor St., (W-1)
Gordon Cameras, Ltd.
45 Kensington High, (W-8)
FRANCE, Paris
Broickiss-Simplex S.A.
6, Rue Guillaume Tell
GERMANY, Hilden Dusseldorf
Gerhard Johansen
3 Lessingstrasse
GREECE, Athens
Christos Axarlis
50 Stadium St.
HONG KONG
Supreme Trading Co.
60 Hennessy Road
INDIA, Bombay
Kine Engineers
26, New Queen's Road
ITALY, Rome
Reportfilm, di J.M. Schuller
Via Antonio Bertolini 31
JAPAN, Tokyo
J. Osawa & Co., Ltd.
5, Ginza, Nishi 2-Chrome, Chuoku
NEW ZEALAND, Auckland
Kerridge Odeon Industries
St. James Building, Queen St.
PAKISTAN, Karachi-3
Film Factors, Ltd.
27 Victoria Rd., Rex Annexe
SOUTH RHODESIA, Salisbury
William Over & Co. Pvt. Ltd.
Kingsway & Manica Road
THAILAND, Suriwong, Bangkok
G. Sinsirakul Co., Ltd.
30 Rattana Avenue

Goldstein, Arthur Allen, Pres., Potomac Photo Supply, Inc. Mail: 1742 Pennsylvania Ave., N.W., Washington 6, D.C. (A)

Gole, Peter, Supvr. A-V Educa., Detroit Board of Education. Mail: 467 W. Hancock, Detroit 1, (M)

Goodfellow, Christy E., Chem. Foreman, M-G-M Labs. Mail: 4133 Jasmine Ave., Culver City, Calif. (A)

Goodwin, Russell T., Chief Projectionist, Stanley Warner Ohio Theatre. Mail: 915 Fifth St., N.W., Canton 3, Ohio. (M)

Getzenberg, Henry, Mot.-Pic. Editor, Hanna & Barbara Prods. Mail: 10238 Clancey, Downey, Calif. (A)

Green, Franklin, Jr., Sensitometry Foreman, M-G-M Labs. Mail: 4266 LaSalle Ave., Culver City, Calif. (A)

Grinberg, Sherman, Pres., Sherman Grinberg Film Libraries, et al. Mail: 1438 N. Gower St., Hollywood 28, (M)

Grossman, Stanley Joseph, Univ. Calif. L. A. Mail: 580 Gayley Ave., Los Angeles. (S)

Gula, Armando E., Chief Eng., Radio Caracas TV. Mail: 3a Avenida No. 42 Altamira, Caracas, Venezuela. (A)

Haentzschel, Wilfred C., TV Producer-Dir., USIA. Mail: 5634 N. 19 St., Arlington 5, Va. (A)

Hance, Richard K., Photo News Editor, WGN-TV, Chicago. Mail: 5 E. Elm Ave., Roselle, Ill. (M)

Hanyok, John Michael, Supvr. Photo Lab. Techn., U.S. Naval Photo Center. Mail: 23 N. Ridge Rd., Greenbelt, Md. (A)

Harris, James H., Jr., SFC, Proj. Eng., Facilities Br., TV Div., U.S. Army Pictorial Center (6400), 35-11 35 Ave., Long Island City 1, N.Y. (M)

Hatcher, William H., Chief Cinemat., WTOK-TV, Box 1771, Meridian, Miss. (A)

Hay, Lewis R., TV Techn., Canadian Broadcasting Corp. Mail: 28 Fraserwood Ave., Toronto 19, Ont., Can. (A)

Hellig, Morton Leonard, Free-Lance Dir., Cameraman, 10 Sheridan Sq., New York. (M)

Heinrich, Fred O. L., Univ. So. Calif. Mail: 3915 Stevely Ave., Apt. 10, Los Angeles 8, (S)

Heltman, Dennis E., Printer & Processor, W. A. Palmer Films Inc. Mail: 1539 Encinal Ave., Apt. 7, Alameda, Calif. (A)

Henderson, Ralph Greig, Prodn. Mgr., Associated Telefilms, % K. L. Carroll & Co., G.P.O. Box 41A, Adelaide, S. Australia. (A)

Herbst, Seymour, Registered Architect, 645 E. Tremont Ave., New York 57, (M)

Hill, Sydney V. C., Films Officer, Govt. of Trinidad & Tobago. Mail: 36 Hunter St., Port-of-Spain, Trinidad, B.W.I. (A)

Hoenke, Norman, Film Lab. Foreman, M-G-M Studios. Mail: 455 S. Berendo, Los Angeles 5, (A)

Howard, Walter, Lab. Techn., National Film Board. Mail: 7509 Earle Rd., Cote St. Luc, Montreal, Que., Can. (A)

Hudson, G. F., Tech. Buyer, Canadian Broadcasting Corp. Mail: 4432 King Edward Ave., Montreal 28, Que., Can. (A)

Huff, Malvin, Project Eng., Schick Safety Razor Co., Research Labs. Mail: 5702 W. Olympic Blvd., Los Angeles 36, (M)

Jackson, John E., Chief Evalua. Eng., Audio Devices Inc. Mail: 1 Loundsbury Ave., Norwalk, Conn. (M)

Jacob, Seymour, Vice-Pres., A-V Sales Exec., Radiant Mfg. Corp. Mail: 8220 N. Austin Blvd., Morton Grove, Ill. (A)

Jones, Harry V., Mot.-Pic. Film Lab Techn., M-G-M Labs. 11833 Stanwood Dr., Los Angeles 66, (A)

Jones, Michael B., Video Tape Eng., WTIV-TV. Mail: 1015 E. Edwards, Indianapolis 27, Ind. (A)

Kaiser, Henry R., Eng., WIIC-WWSW, 341 Rising Main Ave., Pittsburgh 14, Pa. (M)

Katz, Elie C., Electr. Eng., Camera Equipment Co. Mail: 140-60 Beech Ave., Flushing 55, N.Y. (M)

Kemper, Victor J., Vice-Pres., Engrg., General Television Network. Mail: 245 Passaic Ave., W. Caldwell, N.J. (M)

Kimura, Tsutomu, Resident Eng., Japan Broadcasting Corp. Mail: Kissen Ter., Rm. 204, 43-44 Kissen Blvd., Flushing 55, N.Y. (A)

King, Charles A., Sound Recording Eng., General Electric Co. Mail: 652 Morris St., Albany, N.Y. (A)

Knapp, Christopher F., Eng., Technicolor Corp. Mail: 2844 Lambert Dr., Hollywood 28, (M)

Kobsted, Frederick, Staff Photo, CFCN-TV, Photo Dept., Broadcast House, Calgary, Alta., Can. (A)

Koester, Gerhard H., Electr. Eng., Bach Auricon Inc. Mail: 549 Muskingum Pl., Pacific Palisades, Calif. (M)

Kotula, Robert T., Rental, Repair Mgr., Action Industrial Photo, Inc., 3045 Copper Rd., Santa Clara, Calif. (A)

LaBau, Thomas C., Chief, Mot.-Pic. Unit, Thiokol Chemical Corp. Mail: 36 E. Main St., Hyrum, Utah. (A)

Lazarevich, Viadeta, Lab. Techn., Hoffman Semiconductor Div. Mail: 2642 W. Lemoyne, Chicago 22, (A)

Leenders, Paul J. J., Chief Techn., Photo Lab. Head, Training Center for Experimental Aerodyn. Mail: 61, rue Jean Robie, Brussels 6, Belgium. (A)

Leeson, Stanley John, Eng., Marconi's Wireless Telegraph Co. Ltd. Mail: 54 Hampton Rd., Chelmsford, Essex, Eng. (A)

LeFebvre, Don C., Sr. Eng. Writer, Westinghouse Electronics Div. Mail: R.D. 2, Box 491, Severna Pk., Md. (A)

Lenfest, George, Dir., Opera., WRCV/WRCV-TV, NBC, Philadelphia. Mail: 84 Croton Rd., Strathford-Wayne, Pa. (M)

Levine, David, Mot.-Pic. Opera., E. M. Loew's Inc. Mail: 9 Kelley Sq., Worcester, Mass. (A)

Levy, Bernard, Research Cinemat., United Aircraft Corp. Mail: 446 W. Middle Turnpike, Apt. 301, Manchester, Conn. (A)

Loomis, H. Arthur, Supvr. Techn., Projection Service, Eastman Kodak Co. Mail: 31 Little Creek Circle, Rochester 16, N.Y. (M)

Lowdermilk, William F., Communications Media Advisor, U.S.O.M. APO 146, % Postmaster, San Francisco. (M)

MacKenzie, Louis G., Pres., MacKenzie Electronics, Inc. Mail: 1025 N. McCadden Pl., Hollywood 38, (M)

Madden, Joseph F., Negative Cutter, M-G-M Labs. 4255 Baldwin Ave., Culver City, Calif. (A)

Madigan, Michael J., TV Maint. Eng., National Broadcasting Co. Mail: 21 West View Pk., Riverside, Conn. (M)

Makrin, Henry, Sound Techn., Camera Equipment Co. Mail: 21-11 27 St., Astoria 5, N.Y. (A)

Maihotra, Raj Kumar, Elect. Techn., Marquette Univ. Dept. of TV. Mail: 625 N. 15 St., Milwaukee 3, Wis. (A)

Mallett, Philip Wm., Asst. Service Mgr., Bell & Howell Canada Ltd. Mail: 110 Patricia Ave., Willowdale, Ont., Can. (M)

Mann, Samuel, Tech. Supvr., McGraw-Hill Book Co. Mail: 3980 Amboy Rd., Staten Island 8, N.Y. (A)

Marglin, Andrew T., Chief Projectionist, Town and Country Theatres. Mail: 8 Turn La., Levittown, N.Y. (A)

Markley, George, Pos. Devel. Foreman, M-G-M Labs. Mail: 3112 Gilmerton Ave., Los Angeles 64, (A)

Marr, John T., Chief, Processing Branch, Orlando AFB. Mail: 2019 Elizabeth St., Orlando, Fla. (A)

McFall, Lee L., Mot.-Pic. Lab. Techn., Foreman, M-G-M Labs. Mail: 12232 Sunset Blvd., Los Angeles 49, (A)

McGovern, Daniel A., Lt. Col. USAF (Ret), Cons., Lookout Mtn. Air Force Station. Mail: 1327 Wentworth St., Pacoima, Calif. (M)

McKenney, Herbert Baker, Jr., Film Techn., Multichrome Labs. Mail: 147 Broadmoor Ave., San Anselmo, Calif. (A)

McLean, John Hamilton, U.S. Naval Photographic Center, Anacostia. Mail: 6824 Murray Hill Dr., Washington 22, D.C. (A)

Mermad, Jay, Dir.-Coord., Film Services, East Coast, Douglas Aircraft Company, Box 1837, Elgin AFB, Fla. (M)

Miles, Albert Richard, Sound Recording Eng., RCA Service So. Mail: 215 Marshcutz Ave., Huntsville, Ala. (M)

Miller, Adren M., Mgr., Film Recording & TV Systems Ctr., Radio Corp. of America. Mail: 1560 N. Vine St., Hollywood 28, (M)

Miller, Jay, Sensitometry Foreman, M-G-M Labs. Mail: 8513 Croydon Ave., Los Angeles 45, (M)

Mitchell, Michael Joseph, Jr., Electr. Techn., & College Student, Boeing Airplane Co. Mail: 2803-8th Ave., W., Seattle 99, Wash. (A)

Montague, Robert Bevan, Mot.-Pic. Producer-Dir., General Dynamics/Astronautics. Mail: 2803 Mission Village Dr., San Diego 11, Calif. (A)

Moses, Albert Wilson N., Techn., Univ. Khartoum. Mail: Box 32, Khartoum, North Sudan. (A)

Mueller, Hilliard F., Jr., Foreman, Electr. Dept., Board of Education. Mail: 3416 Thomas St., St. Louis 16, Mo. (A)

Munnings, Burton, Company Dir., P.M. Photographic Co. Pty. Ltd., 227 George St., Sydney, Australia (N.S.W.) (M)

Napfel, Hans F., Eng., Fairchild Camera & Instrument Corp. Mail: 825 West End Ave., New York 25, (M)

Neville, John Edward, Closed-Circuit TV Field Eng., Chicago Communications Inc. Mail: 94 Lincoln, Riverside, Ill. (A)

Nelting, Fred, Pos. Timer, Film Techn., M-G-M Labs. Mail: 317 S. Hansworth Ave., Hawthorne, Calif. (A)

Nyquist, Carroll, Production Mgr., Ceneo Educational Films. Mail: 1271 Algonquin Dr., Elgin, Ill. (A)

CAMART PRODUCTS

OPTICAL FX UNIT AND PRISMS

You've got to see it to believe it!

FOR 16mm-35mm-TV CAMERAS

LIVE TV, ANIMATION, MOTION PICTURES



From two to seven images or combinations, more than 27 variations in optical effects, montages, and distortions without expensive opticals.

Images may be photographed in still motion or forward and reverse rotation.

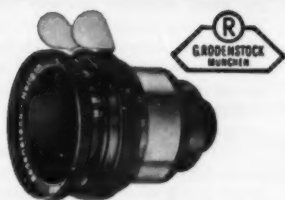
Complete unit consists of a four surface prism, mount, revolving housing, and camera base assembly.

THE CAMERA • MART INC.

1845 BROADWAY at 40th ST. Phone: PLaza 7-6977
NEW YORK 23, N. Y. Cable Address: CAMERAMART

Literature on request.

SELECTION!



**GROENSTOCK
BUSHES**



**SCHNEIDER
OPTIK
KREIZNACH**



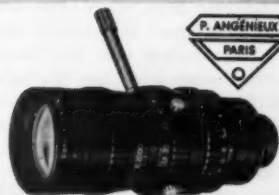
**CARL
ZEISS**



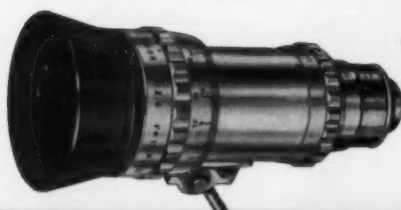
Kieffert



**TAYLOR-
HOBSON**



**P. ANGÉNIEUX
PARIS**



**SOM
BERTHOY**



TEGEA

UNSURPASSED OPTICS for the **ARRIFLEX 16**

Arriflex 16 offers the *widest selection* of the finest lenses. The selection keeps growing —because the *world's most successful portable professional motion picture camera* inspires the greatest efforts of the world's foremost optical firms. Every lens in the Arriflex 16 system adds to this remarkable camera's rare versatility... from the 5.7mm extreme-wide-angle to the longest telephotos, the zooms, and the macros.

ARRIFLEX CORPORATION OF AMERICA
NEW YORK 10, N. Y. • HOLLYWOOD 38, CALIF.



ARRIFLEX CORPORATION OF AMERICA
257-K PARK AVE. SOUTH • NEW YORK 10, N.Y.

Without obligation, I would like:

☐ DEMONSTRATION ☐ LITERATURE
☐ on ARRIFLEX 16 ☐ on ARRIFLEX 35

.....
name
.....
company
.....
address
.....
city zone state



Trends in 70mm Projection Equipment

By GIOVANNI BOZZI

It is our purpose to discuss some of the problems connected with 70mm films which now exist and which may affect the future of 70mm from the European and more specifically from the Italian point of view.

Today the 70mm projector no longer presents a technical problem. There are many manufacturers of 70mm projection equipment. The main problems remaining after the field practice we have all had in recent years are price, installation and servicing expenses. Our situation is considerably different from yours. We are some 8000 miles from Hollywood and almost our only contacts with the 70mm film-producing companies are through their local branches. These contacts are very often unsatisfactory because of the limited facilities and service available. Since we in Italy are directly affected by this situation, our point of view may be of some interest.

Presented on May 9, 1961, at the Society's Convention in Toronto by Giovanni Bozzi, Cinemeccanica S.P.A., Viale Compania 23, Milano, Italy. (This paper was received on May 18, 1961.)

Small Number of Installations

In the past, correspondence with the producing companies, notwithstanding our 6000 customers throughout Europe, Asia, Africa and South America, was practically nil. Recently we have found it necessary to increase our files and our English correspondence in order to answer inquiries from producing companies which have been making continuous and repeated requests for up-to-date lists of 70mm installations. These pressing requests show, no doubt, that one of the bottlenecks preventing the success of 70mm is the small number of installations available. Certainly 70mm can be considered an important step forward in our field, and anything that can be done to improve this situation will help the entire motion-picture industry from producer to exhibitor.

We all know the history of CinemaScope and in my opinion a great deal of guidance can be derived from it. I remember, that in Italy, following the introduction of CinemaScope, its reception was very unenthusiastic until the day when second-run theaters became interested. From that moment, the requests for CinemaScope installations increased at a hectic pace and in less than two years we had in Italy

more than 1000 CinemaScope installations. That avalanche rhythm probably had something to do with our Latin mood; but anyway we feel that when the cost of 70mm projection equipment comes within the reach of second-run theaters, the sluggish progress of 70mm toward success will be considerably accelerated. As more theaters become equipped for 70mm, correspondence between cinema equipment factories and Hollywood producers may no longer be of such urgent necessity, and the best of exhibiting possibilities will raise the level of 70mm film production.

Of course we are not so simple-minded as to believe that the problem of equipment installation and servicing cost is the only one to be solved for the future of 70mm films, but this is an area within which we can do something and so this problem is the one requiring our immediate attention.

American Installations Older

I believe it is necessary to point out some differences between American (and British) installations and installations in continental Europe. To be frank when, a few years ago, I visited some American booth installations, I received a very bad impression. Not only did the age of the American installations seem generally older than that of comparable European installations, but in America I noticed, quite frequently, assemblages of pedestals, amplifiers, speakers from different sources, different ages and with adaptation brackets, plates and bolts. To assemble so many heterogeneous parts of assorted vintage would require much skill, but in my opinion this would make for very good operating results.

European Installation Practices

In Europe, each manufacturer generally provides a complete line, from the pedestal to the optical head, from the mechanism to the speaker, and when an installation is changed, a completely new unit is installed. In such a situation, the manufacturer can take the whole responsibility of the equipment, and we think this ensures better and more reliable installations. Therefore, if only one company supplies the equipment, that company can arrange for a step-by-step procedure so that 70mm can be simply and intelligently achieved, starting from a normal 35mm optical installation.

It is a most disappointing development that in Italy, as well as in other countries, despite the considerable effort and expense undertaken by manufacturers and exhibitors to provide 70mm facilities, we received very few 70mm prints, and in the case of the long-heralded spectacular, *Ben-Hur*, only 35mm prints were distributed.

You can understand that this was a particularly bitter disappointment.

Prospects and Plans

In this respect, should we not try to solve the riddle of "which comes first, the chicken or the egg" by asking the following question: could we assist in this problem by introducing a 35mm optical equipment, comparable in price to American 35mm projectors, which will provide for

at your service!

16^{MM}



reversal printing and processing

COLOR PRINTING

• Fastax Service	• Work Prints
• A&B Roll Prints	• Color-to-Color Prints
• Fades-Dissolves	• Color-to-B & W Prints
• Timed Prints	• Raw Stock

Write for complete information . . .

LAB-TV

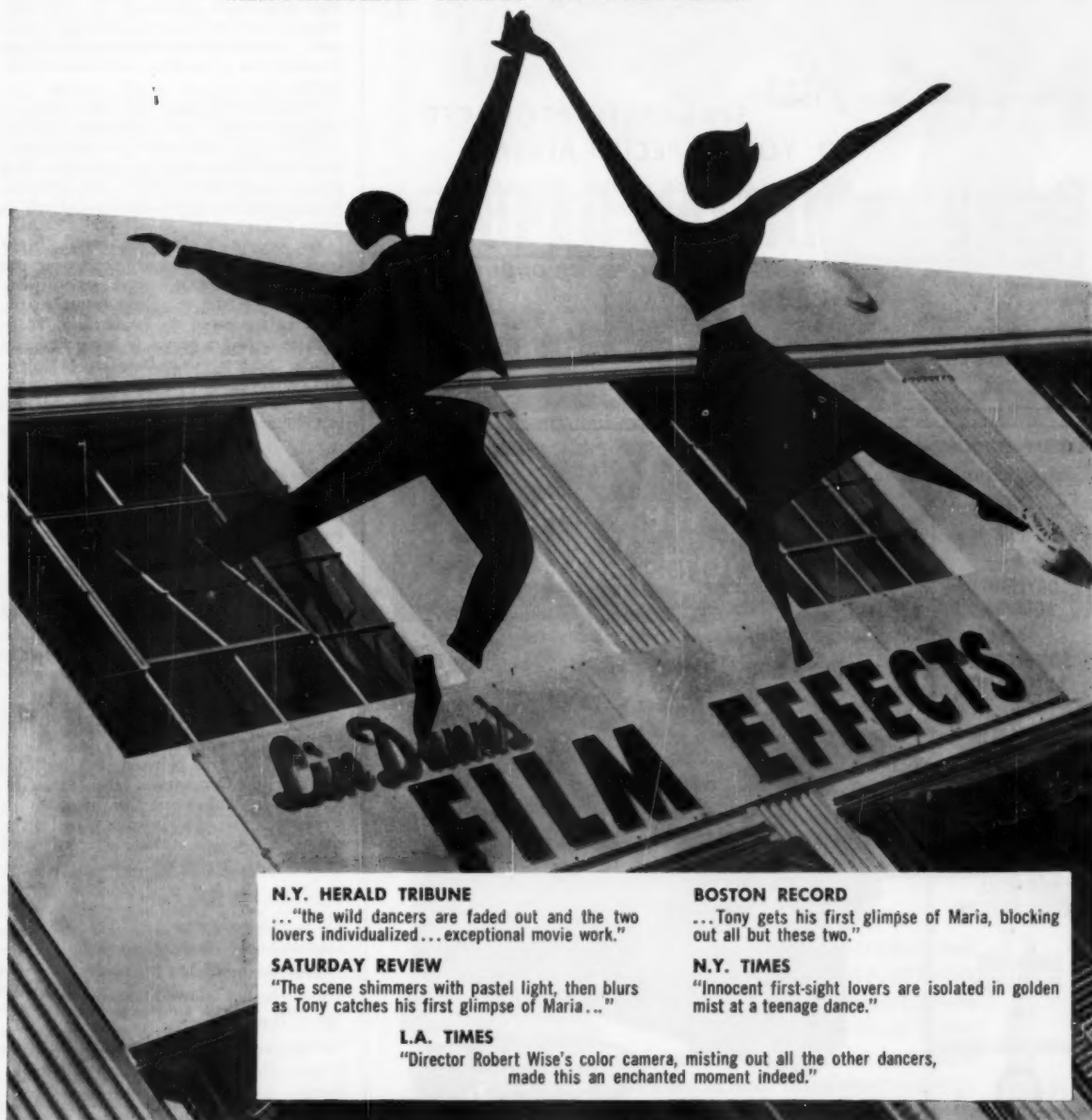
723 Seventh Avenue
N. Y. 19, JU 6-2293

"WEST SIDE STORY...PHOTOGRAPHIC EFFECTS BY LINWOOD DUNN AND FILM EFFECTS OF HOLLYWOOD HAVE REALIZED TRICKY AND IMPORTANT INNOVATIONS."

Hollywood Reporter • Sept. 22-1961

This same service...in every aspect of Creative Special Effects...backed by thirty years of major studio experience and the finest specialized equipment...available for your 16 mm, 35 mm and 65 mm production.

WRITE FOR BROCHURE • PHONE HO 9-5808 • CABLE: FILMEFX



N.Y. HERALD TRIBUNE
... "the wild dancers are faded out and the two lovers individualized... exceptional movie work."

SATURDAY REVIEW
"The scene shimmers with pastel light, then blurs as Tony catches his first glimpse of Maria..."

L.A. TIMES
"Director Robert Wise's color camera, misting out all the other dancers, made this an enchanted moment indeed."

BOSTON RECORD
... Tony gets his first glimpse of Maria, blocking out all but these two."

N.Y. TIMES
"Innocent first-sight lovers are isolated in golden mist at a teenage dance."

FILM EFFECTS OF HOLLYWOOD
Linwood Dunn ASC, President

1153 No. Highland Ave. Hollywood 38, Calif.
Phone HO 9-5808 • Cable: Filmefx

send for this **NEW BROCHURE SP-52**

on
**FILM SPROCKETS
STOCK ITEMS**

(IMMEDIATE DELIVERY)

for 16 mm., 35 mm. and
70 mm. films. Like all
LaVezzi products these
sprockets are of highest
quality, assuring smooth
operation . . . and long,
trouble-free life.



Also
**SPROCKETS PRODUCED
TO YOUR SPECIFICATIONS**

in all practical materials, all sizes and types,
small or large quantities, for all applications.
For information or quotes

write, wire, or phone

**SPROCKET
SPECIALISTS**
SINCE 1908

LaVezzi **MACHINE WORKS**
4635 WEST LAKE ST., CHICAGO, ILLINOIS
Telephone ES 8-1636

★
SPEEDS TO
20 FT. PER MIN.

★
DAYLIGHT
LOADING

★
COMPLETELY
AUTOMATIC

★
VARIABLE
SPEED DRIVE

★
AUTOMATIC
REFRIGERATION

★
CHEMICAL
RECIRCULATION

★
COMPLETE
PLUMBING
★



**ALLEN REVERSAL
PROCESSORS**

Model 500



**PRICES START AT
\$2995.**

For complete information, write:

ALLEN PRODUCTS, INC. Milford, Connecticut

changing from 35mm optic to 70mm mag-
netic very easily by interchanging parts
resulting in a 70mm projector meeting the
highest standard of the industries?

I think such equipment would be en-
thusiastically accepted by those exhibitors
who need replacement of equipment or
who are contemplating new theaters.

With the situation now prevailing in
respect to 70mm film release, exhibitors
are afraid of investing money in some
useless gimmick or of putting into the
booth some equipment which would be-
come obsolete in a few years. If realistically
priced equipment, with interchangeable
sections, were available, theater owners
could be assured of a permanent installa-
tion for their investment. We believe that
marketing such equipment is the only
way to provide projection facilities for a
more substantial production of 70mm
films and for a complete utilization of the
prints.

Such equipment would also make it
easier to extend 70mm projection facilities
to drive-in-theaters, which are particularly
in need of 70mm film for improving their
projection standards, which are presently
very low for lack of definition and of bright-
ness.

We believe that we are on the right
track and we are presently developing this
type of equipment. We hope that our work
will result in the very near future in the
deserved success of the 70mm film. Three
of these units are presently being tested in
regular theaters, one in Italy, one in France
and one in Switzerland. By the end of the
year we expect to be making regular
installations.

SMPTE Test Films

The Society has available a number of
films for testing projection and sound
equipment in the various fields listed below.
These films are planned by SMPTE
Engineering Committees and manufactur-
ed to a high degree of precision to
serve the needs of maintenance and other
engineers, dealers, manufacturers, and
audio-visual equipment users.

Television—Picture Only

35mm—Cinemascope

35mm—Picture Only

35mm—Sound Only—Photographic

35mm—Sound Only—Magnetic

70mm Test Films

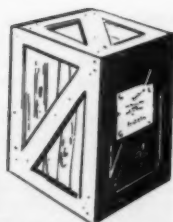
16mm—Sound Only—Magnetic

16mm—Picture and Photographic Sound

16mm—Sound Only—Photographic

16mm—Picture Only

A catalog containing details and prices
of all the films available in these categories
can be obtained from SMPTE head-
quarters.



new products (and developments)

.....
Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.

The WF-30 Fastax 16mm high-speed camera (Wollensak Optical Co., 850 Hudson Ave., Rochester 21, N.Y.) does not "incorporate an RFI-protected oscillograph," as erroneously noted in the October 1961 *Journal* (p. 856); it is RFI-protected so that interference with an oscilloscopic pattern being recorded is reduced or eliminated. The firm also has designed a high-speed oscilloscopic recorder, the WF-32 which has some specifications such as those for film and magazine which are the same as the WF-30, the high-speed motion-picture camera. Features of the WF-30 include a 1200-ft magazine, speed of 500 to 3000 pictures/sec (12.5 to 75 ft/sec), flat speed curve regulated to $\pm 4\%$, and special start-stop control.

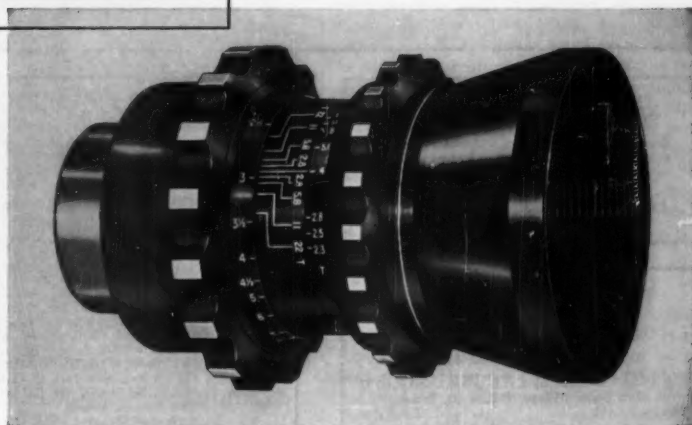
A photoinstrumentation system designed with self-contained facilities for the study of high-speed transient events with velocities up to 200,000 ft/sec and duration times as short as 5×10^{-9} sec has been introduced by Beckman & Whitley, Inc., San Carlos, Calif. The system, designated Model 339B, has been used, with special optical adaptation, to record the time required for a pulse of light to traverse a 6-ft space (6×10^{-9} sec). The system is designed around a sweeping-image camera with a high-speed rotating mirror which sweeps an image of the event under study past a slit and onto a stationary film strip. The speed range of the turbine-driven mirror is 200 to 2600 rps, at which speed the recording time is 131 μ sec total and the recording rate is 9.05 mm/ μ sec.

The film record occupies 46.5 in. of a 48-in. strip of 35mm film. The field of view is 0.053 in. by 18 in. at 10 ft and the maximum effective aperture $f/8.0$ at the film plane. The system is of the continuous recording type to eliminate necessity for synchronization between the event and the system.

A vacuum pumping system and the electronic circuitry are contained in the mounting stand of the sweeping-image re-

SMPTE Lapel Pins. Gold and blue enamel reproductions of the Society symbol, with screw back. Available to all members from Society headquarters. Price \$4.00 incl. Fed. Tax; in New York City, add 3% sales tax.

New!



SUPER BALTAR* LENSES

...featuring today's highest resolution for wide screen, television and photo instrumentation

This new Super Baltar line of matched motion picture lenses complements and expands the famed Baltar series to include 70 mm coverage. And it balances illumination, flattens the field, and heightens contrast like no lens you've ever seen! You get high picture fidelity from corner to corner, edge to edge, of the film frame—dependable result of the most critical optical characteristics ever built into a professional lens.

Features include: minimum back focus of 32 mm; choice of mounts, barrel or custom focusing, to meet your specific needs; seven focal lengths, from 25 mm to 9", optically centered to full aperture; 70 mm coverage with 3", 4", 6", and 9" lenses.

Write for Technical Publication F-162, Bausch & Lomb Incorporated, 72223 Bausch St. Rochester 2, N. Y.

*Trademark Bausch & Lomb Incorporated

Academy of Motion Picture Arts and Sciences
Honorary Award for Optical Service to the Industry

BAUSCH & LOMB

SINCE 1859



Revolutionary new
Mitchell R-35 Reflex
Studio Camera
features new Super Baltar
Lenses—in special focusing mounts
designed by B&L in collaboration with
Mitchell engineers.

Professional Services

TIME LAPSE — HIGH SPEED SCIENCE MOTION PICTURES

Bacteriology, chemistry, scientific special effects applied to motion pictures and TV
Consultation and production since 1929
THE BERGMAN ASSOCIATES
732 Eastern Parkway, Brooklyn 13, N. Y.
SLOcum 6-0434

IN THE SOUTHWEST

For Equipment and Stage Rental
Technical and Creative Personnel
Complete 16mm and 35mm
Laboratory and Producer Services
It's BIG "D" FILM LABORATORY, Inc.
4215 Gaston Plaza, Dallas 10, Texas.
TAylor 7-5411 L.A.T.S.E.

8MM SOUND STRIPING CINECRAFTERS

DEPT. S, 219-44 JAMAICA AVENUE
QUEENS VILLAGE, N. Y.

CRITERION FILM LABORATORIES, INC.

Complete laboratory facilities for 16
& 35mm black-and-white and color
33 West 60th St., New York 23, N. Y.
Phone: COLUMbus 5-2180

ELLIS W. D'ARCY & ASSOCIATES

Consulting and Development Engineers
8mm Magnetic Sound Printers
Motion-Picture Projection
Magnetic Recording and Reproduction
Box 1103, Ogden Dunes, Gary, Ind.
Phone: Twin Oaks 3-421

16mm SOUND

Modern Sound
Recording Studio
Narration Recording
Magnetic & Optical
Rerecording & Mixes
Music-Effects Library
FISCHER PHOTOGRAPHIC LABORATORY, INC.
6555 North Ave., Oak Park, Ill., EUclid 6-6603

RENT

SEND FOR
CATALOG

GORDON ENTERPRISES

5362 N. Cahuenga, North Hollywood, Calif.

REELS • CANS • FIBER CASES

MOTION PICTURE ENTERPRISES

Tarrytown 83, N. Y.

N.Y.C. Tel: Circle 5-0970

TUFF COAT

Cleans, kills static, lubricates and invisibly coats and protects all types of film against scratches and abrasions. SAFE, easy to use. NO carbon tet. Special type available for magstripe and video tape. Write for brochure "S".

NICHOLSON PRODUCTS COMPANY
3403 Cahuenga Blvd. Los Angeles 28, Calif.

SAVE 25-50% ON PRINT COSTS

Users of Permatil Protection and
Ferma-New Scratch Removal show
savings ranging from 25% to 50%
and more by lengthening the life of
their prints. A money-back test will
convince you.
PERMAFIL INCORPORATED
723 7th Ave.-New York 19-CI 6-9139
PERMAFIL INC. OF CALIFORNIA
7264 Melrose Avenue
Hollywood Webster 3-8245

PHOTOGRAPHIC INSTRUMENTATION Specializing in HIGH-SPEED

Motion-Picture Photography
Photographic Analysis Company
100 Rock Hill Rd., Clifton, N. J.
Phone: PRescott 9-4100

SUPPLIERS PHOTOGRAPHIC CHEMICALS and

Consultants in Photographic Chemistry
L. B. Russell Chemicals, Inc.
14-33 Thirty-First Avenue
Long Island City 6, New York
RAvenwood 1-8900

FILM PRODUCTION EQUIP.

SALES World's largest source—practically every need for producing, processing, recording, editing motion picture films.
LEASING S.O.S. Photo-Cine-Optics, Inc.
SERVICE formerly SOS Cinema Supply Corp.
New York City: 662 West 82nd Street, Plaza 7-6440
Hollywood, Calif.: 6331 Hollywood Blvd., HO 7-2124

* SYNCHRONOUS MAGNETIC FILM RECORDER/REPRODUCER

* MAGNETIC TAPE RECORDERS
* NEW—THE portable MINITAPE synchronous
13 lb. battery operated magnetic tape
recorder for field recording.

THE STANCIL-HOFFMAN CORP.
845 N. Highland, Hollywood 28
Dept. 5 HO 4-7461

16mm CENTRAL PROCESSING SERVICE

Anisochrome Ektachrome ER
Reversal—Negative—Positive
Printing—Recording—Rental—Editing
WESTERN CINE SERVICE, INC.
312 S. Pearl Ave., Denver 9, Colo.
Sherman 4-1017

PRECISION OPTICAL ETCHING

Reticles-Viewfinders-Scales-Ground Glass &
Opaque Reticles
For TV-Motion Picture-Optical Instrument
Engineers

E. YOUNGLING
24 Collins Rd., Glen Cove, L. I., N. Y.
Oliole 6-7774

corder. Pushbutton controls for viewing, static exposure and instantaneous exposure are located near the microscope and the full-viewing eyepiece. Precision frequency-counter equipment and firing controls are located in a remote console which permits operation of the system from a distance when recording hazardous events. An additional high-voltage pulse unit is incorporated to provide a source of high-energy high-voltage electrical pulses for the instantaneous initiation or precise delay of exploding wire, spark gaps, electronic fuses, flash bombs, explosive shutters and lighting devices.

Typical applications include detonation explosive studies, plasma investigation, flash tube and spark discharge phenomena, simultaneity of plane-wave generation, shock-tube work, exploding-bridge wire observations and simulated nose-cone re-entry studies.

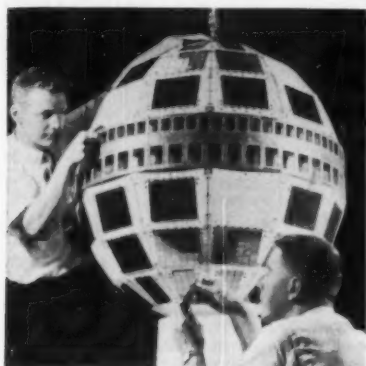
The new DBM 10 Camera has been designed and manufactured by the D. B. Milliken Co., Arcadia, Calif., to meet the requirements of the Project Bigshot, Echo A-12, recoverable capsule. It will be used for surveillance and measurements during the ejection of the Echo A-12 communications balloon. With a basic Milliken movement, the camera operates at 16 or 24 frames/sec with register pin for high definition, resolving in excess of 200 lines/mm. It is hermetically sealed for submerged or explosive environments in a housing manufactured to sustain an 80 G load.

A series of high-power oscillators covering frequencies from 5 mc to 1250 mc has been announced by Telonic Industries, Inc., Beech Grove, Ind. Manufactured in seven versions with various center frequencies, the oscillators are used for CW or sweep oscillation in instrumentation and other systems requiring power levels from 1 to 8 w. The units are equipped with a gear-driven tuning mechanism and dial assembly and an r-f low-pass output filter with a cutoff at the high end to reduce harmonic content. Power requirements are 50 to 100 ma at 400 to 900 v or 1.0 amp at 6.3 v. Price of the unit is approximately \$1750.

A new material — neodymium in calcium tungstate — has been found to be a good maser material through research carried out at Bell Telephone Laboratories, Murray Hill, N.J. The potentialities of this material were revealed by the discovery of a strong infrared fluorescence. With crystals pulled from the melt, an optical maser was constructed that operates at room temperatures with as little as 5 joules of input power. The emission line is in the desirable (photographable) part of the infrared region.

The new model 5Mc-2P/R dual gun compact oscilloscope, a product of Packard Bell Electronics, P.O. Box 337, Newbury Park, Calif., weighs 22 lb and contains only two types of vacuum tubes. It has two identical vertical amplifiers, each with a bandpass of d-c to 5 Mc and a sensitivity of 100 mv to 100 v continually adjustable. A built-in preamplifier increases the sensitivity of the lower amplifier to 1 mv/cm. The sweep is from a Schmitt Trigger with both internal and external triggering

capabilities. Linearity of the sweep is 1% from a constant current, RC network. The price is \$570.00.



A developmental model of a communications satellite, scheduled for orbiting next spring, has been constructed at Bell Telephone Laboratories. Used for communications experiments, it is located in a specially constructed laboratory simulating the radio environment of space. Designed for relaying overseas communications, including television and telephone calls, the 34-in. sphere is covered with arrays of solar cells which convert sunlight into electricity. Microwave receiving and transmitting antennas form a belt around the middle of the satellite.

The Pixicam, Model EC1, self-contained television camera for closed-circuit use, produced by American Telecircuits Div., Marsan Industries, Inc., 49 Edison Place, Newark, N.J., uses a new 2-in. camera tube, called the Pixicon. The camera employs a 7-tube circuit, and is said to be capable of 400 lines of video resolution. In addition to providing output signals at both video and r-f channel frequencies, the camera is designed to add sound automatically to the picture from a standard microphone, tape recorder or record player. Any standard television set can be used to receive the pictures. It is priced at about \$399.50 including an f/1.9 lens.

Audimax—the automatic level control device to maximize audio coverage—has just been introduced by CBS Laboratories Div. of Columbia Broadcasting System, Inc., Stamford, Conn. Average broadcast modulation is said to be increased by 6 db with a corresponding increase of 300% in radiated program power. A unique feature is a central memory section which retains a 10-sec past history of program content, compares the instantaneous program signal with this past history, and then adjusts amplifier gain to the most advantageous level.

A 20-w uhf translator was introduced by Adler Electronics, Inc., One Lefevre Lane, New Rochelle, N.Y., at the National Association of Broadcasters Convention held during October in Washington, D.C. Specializing in the design and manufacture of educational TV equipment, the firm has announced the new translator as having twice the power of previously developed units.



A 2-head transistorized industrial videotape recorder has been announced by Sony Co., Ltd., 351 Kitashinagawa-6, Shinagawa-Ku, Tokyo, Japan. The equipment uses transistors and diodes and its physical dimensions (900 X 600 X 900mm) are said to be less than one-tenth those of existing broadcast-use equipment. A maximum of 740 meters of 2-in. tape can be accommodated at a speed of about 180mm per second, giving up to 67 minutes of recording time. The low tape speed is said to reduce wear on the heads. The tape can be stopped for single-frame observation, or

run in slow motion. Price is approximately 3,000,000 Yen.

A 2-in. magnetic tape developed for use with the VR-8000 closed-circuit Videotape recorder has been introduced by Ampex Corp., Redwood City, Calif. Because the closed-circuit recorder employs a single-head, helical-scan recording technique, the oxide particles on the tape are magnetically aligned lengthwise along the tape. The tape is spooled with the oxide part on the outside because of the closed-circuit recorder's requirements. Tape for the VR-1000 is spooled with the oxide on the inside. The longitudinal orientation of the oxide particles is accomplished by passing the tape through a magnetic field.

A compact tape recorder has been designed by Radio Corp. of America especially for classroom and other educational uses. Called the TR-11, the recorder occupies only 10 sq ft of floor space. It has been installed in a van by Station WHA-TV (University of Wisconsin) for on-the-spot recording of state-wide events, such as laboratory experiments, demonstrations, lectures, etc. The new recorder is also in use at Maxwell Air Force Base, Montgomery, Ala., as part of a closed-circuit TV system for the instruction of some 2000 Air Force officers grouped at 165 viewing locations. The machine uses 2-in. magnetic tape and can record up to 96 min. on a standard reel of tape. The new recorder is a simplified version of the RCA standard tape recorder for commercial broadcasters.



DIRECTOR'S FINDER

from Birns & Sawyer—Hollywood

Optical Zoom Finder shows exact lens field instantly! No guesswork for proper focal length, camera position or dolly shot!



- | | |
|---|---------|
| 2606: Model K, 16mm format range 8mm to 75mm..... | \$79.50 |
| 2610: 35mm Model 11, Range 25mm to 150mm..... | 79.50 |
| 2611: 35mm—TV/Lease Orthicon TV scribed, Range 35 to 150mm..... | 84.50 |
| 2615: 35mm Cinemascope Model 111 adjustable matte, format 1:1.85, 2.33, 2.55..... | 129.50 |
- Prices include case and chain. Insist on Original TEWE for quality.



A MUST FOR CAMERA-MAN AND DIRECTOR ALIKE!

LONG L-O-N-G LENSES

FROM BIRNS & SAWYER — HOLLYWOOD

Omnitar Lens System—125mm to 2000mm—for All Cine Cameras:



Mounted for Arri 16 & 35, Mitchell 16 & 35, Fastax 16 & 35, Eyemo 35, "C"-Mounts, Photo-Sonics 16, 35 & 70; Cine-Special.



Fast, Brilliant Omnitars Fit 28 Still Cameras: Nikon F, Alpa, Hasselblad, Exakta, Pentax, Praktina, Topcon, etc.

SEE YOUR DEALER, or write:

BIRNS & SAWYER Cine Equipment

PHONE: HOLLYWOOD 4-5166 6424 SANTA MONICA BLVD HOLLYWOOD 38, CALIF

Tapes made on either the TR-11 or the standard recorder are interchangeable.

A **bandpass filter** designed to provide pure sinusoidal reproduction of the fundamental input has been announced by CircuitDyne Corp., 480 Mermaid St., Laguna Beach, Calif. Called the FB-1, the retriever is said to provide 50 db minimum attenuation at and above the second harmonic of the input's lower band edge and the same attenuation at and below one-half the upper band edge. Band-edge response is held to within 2 db of center frequency and the output is reported to contain less than 1% harmonic distortion with second harmonics of up to three times the fundamental amplitude. Prices range from \$20.00 to \$60.00.

An **8mm color film** balanced for photoflood illumination has been introduced by Ansco, a Division of General Aniline and Film Corp., Binghamton, N.Y. Called Moviechrome 8 Type A, the new film is designed especially for use under artificial lights. It can, however, be used under daylight conditions with an 85 (Type A) filter. Based on normal camera speed of 16 frames/sec, the exposure tables call for photoflood lamps or light bar in 300- or 375-w sizes. The colors in the new film are organic dyes tested for permanence and light fastness.

Hi-Impact Treatment FCP is the name of a new process developed by Peerless Film Processing Corp., 165 West 46 St., New

York 36, and 959 N. Seward St., Hollywood 38. This new treatment is reported to eliminate friction, and thus to prevent binding or jamming of continuous projection films, by holding apart the convolutions of the film. This process is designed to toughen the film so as to enable it to withstand repeated exposure to heat during projection without buckling and to make it resistant to dirt, scratches and brittleness.

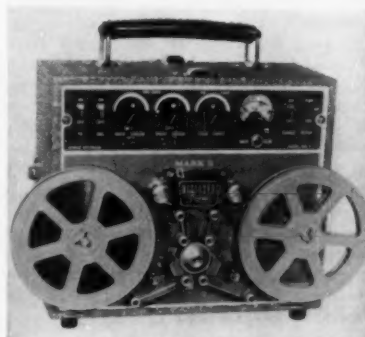


A wide-angle 70mm camera and a projector designed and manufactured by Benson-Lehner Corp., 1860 Franklin St., Santa Monica, Calif., will be used for the first time at the Century 21 Exposition Spacearium, in Seattle, Wash., beginning April 21, 1962. A 12-minute space voyage film produced by Cinerama will be projected onto a 75-ft diameter, 8000 sq ft hemi-

spherical screen designed to give the spectator the illusion of being within the environment of the film. The 70mm equipment is produced under contract with Cinerama. The camera is used with a wide-angle lens providing 160° field of vision in any plane. The Spacearium is sponsored jointly by Cinerama, the Boeing Co. and the U.S. Science Exhibit of the Department of Commerce.

A new **shoulder support** for mobile camera operation with the Arriflex 16 is announced by the Arriflex Corp. of America, 257 Park Ave. South, New York 10; and 826 North Cole Ave., Hollywood 38. It consists of an all-metal shoulder stock with pistol grip, usable with all models. The pistol grip is removable and, by means of a special counter-plate, may be used by itself on the Arriflex 16. The combination shoulder-pod pistol grip, available through all Arriflex dealers, sells for \$68.00.

A **companion charging unit** for the Dynamax Power Pack, a sintered-plate nickel cadmium storage battery, has been announced by Gordon Enterprises, 5362 No. Cahuenga Blvd., North Hollywood. The charger is said to re-energize a completely discharged battery overnight. The Power Pack, designed to supply from 6 to 24 v for motion-picture cameras and similar uses has a 6 to 10 amp/hr capacity and can be repeatedly recharged.



The **Nomad Mark 2** is a new portable recorder/reproducer manufactured by Magnasync Corp., 5546 Satsuma Ave., North Hollywood, Calif. This transistorized equipment weighs 12 lb and operates with 20-w power. Other features include instantaneous "film direct" monitoring. Designed to produce at SMPTE Standards, the machine runs forward and reverse. It is equipped with a rewind, rechargeable battery and built-in battery charger. Projector interlocks are available. The unit records a 200-mil track on split 16mm Nomad film, 400-ft capacity. The standard model is priced at about \$985.00. Stereo models are available.

New **sound and heater Barney's** for the Eastman Kodak reflex camera have been announced by Birns & Sawyer Cine Equipment Co., 6424 Santa Monica Blvd., Hollywood 38. The sound Barney for the 400-ft load camera with synchronous motor is priced at \$124.50. Price of the heater Barney for the same camera is

→ S.O.S. EDIOLA PRO-35

**Professional Precision
at a Price!**

Available with
Optical/Magnetic or
Combination Sound Reader



- Large Screen: 4 1/8" x 6 1/16"
- Brilliant Picture Image
- 75 watt lamp; fan cooled
- Velvet action Nylon Rollers
- Film travels Left to Right
- Simplified Framing and Focusing
- 4-sided Prismatic Shutter
- Lightweight, compact design

A 35mm **ACTION VIEWER** designed for easy editing. Precision optics assure bright pictures in sharp focus whether film is moving or stopped. Film protected from overheating or burning. No intermittent or oscillating parts. Free turning sprocket guards against film damage.

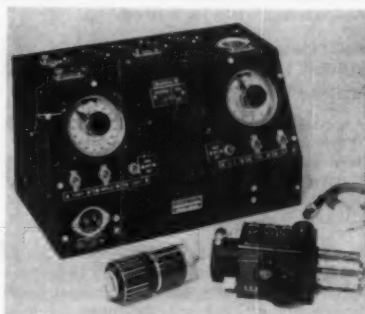
SPECIAL INTRODUCTORY OFFER!

S.O.S. EDIOLA PRO-35..... **\$295**
S.O.S. Pro-35, Optical Sound Reader and Base..... \$495

S.O.S. PHOTO-CINE-OPTICS, INC.
formerly S. O. S. CINEMA SUPPLY CORP.

602 WEST 52nd ST., NEW YORK 19, N. Y. • Phone: PLaza 7-0440 • Telegram: QHP, N.Y.
Western Branch: 6331 Hollywood Boulevard, Hollywood 28, California • Hollywood 7-2124

\$184.00. The sound barney has a velcro-closure, located on the righthand side, which opens so that the operator has access to the camera controls.



A series of Master Intervalometers (available in four different models) for use with Arriflex cameras has been announced by the Arriflex Corp. of America, 257 Park Ave. South, New York 10. The equipment is designed to give framing rates adjustable from 1 sec to 25 min or, on special order, as long as 10 hr. Automatic exposure times of 1/10, 3/10 or 9/10 sec, or 1/4 or 1/2 sec are obtained directly from the standard single-frame drives. Two models of the Master Intervalometer, when used with specially adapted single-frame drives, will, in addition, provide adjustable time exposures. Time exposures may be set from 1 sec to 10 sec and, on special order, may be as long as 60 sec. All models automatically control lights and 115-v a-c auxiliary equipment up to a total of 1500 w. Two models have a built-in 8-v d-c supply also. The four models range in price from \$425.00 to \$710.00.

A complete line of transistorized audio/PA amplifiers has been announced by Continental Manufacturing, Inc., 1612 California St., Omaha, Neb. The Model LT-80, an 8-w continuous duty amplifier, is the first of the series to be available. It is specially designed for background music and public address applications. The Model LT-300, a 32-w transistorized amplifier, will be available shortly.

A solid state voltage reference device called the PR1 has been announced by Circuit-Dyne Corp., 480 Mermaid St., Laguna Beach, Calif. Features include isolation from line voltages in the order of 100 db. Each unit is packaged in an hermetically sealed container, 2 in. high and 1 1/4 in. in diameter. Output voltages for each unit are calibrated and stamped on the case. Price range is from \$30 to \$130.

A new form of crystal growth of silicon which may have important implications for semiconductor devices has been reported by Bell Telephone Laboratories, Murray Hill, N.J. In the process, silicon is reacted with iodine and hydrogen, together with small amounts of arsenic and nickel, at high temperatures in a closed tube. The ribbons, with silicon whiskers of a hexagonal cross-section, grow rapidly in the hot tube. They vary from 0.1 to 15 microns in thickness, are about 0.1 mm wide, and from 1 to 3 cm long.

employment service

.....
These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Cameraman—Optical Printing Specialist. Long experience Hollywood studios and East Coast laboratories; own bench optical printer assembled with Acme camera (35) and projector (35 & 16) printing Eastman Ektar, 1000-ft bi-pack for masters, plus all accessories, cost \$18,000. Seek association with producer or laboratory including equipment at nominal fee or will sell machine at less than half original cost. Last 8 yrs chief optical printing at Consolidated Film Industries, Fort Lee. Will relocate. W. G. Heckler, 21 West 58 St., New York 19. PL 3-7067.

Audio-Visual Specialist. Extensive communications background: motion pictures, radio, audio-visual techniques. Over 5 yrs experience in motion-picture production and direction, script writing, editing and industrial audio-visual department administration. Secondary experience as radio news, script and continuity writer and in editing and writing of technical reports, proposals and brochures. Age 29, married, B.S., M.S. in Audio-Visual Communications. Willing to relocate. Resume on request. P.O. Box 502, Stamford, Conn.

Positions Available

Electronic Engineer. To supervise Sound Maintenance Dept. of large modern motion-picture studio. At least 5 yrs professional experience in sound recording essential. Thorough knowledge of solid state and tube audio circuits, magnetic and optical sound recording systems, sensitometry and transmission measurement techniques required. Must have ability to do independent design work on special projects. Administrative experience desirable. Excellent working conditions in suburban Montreal. Send resume, with academic background, to: Personnel Dept., National Film Board of Canada, P.O. Box 6100, Montreal, Que., Canada.

Photographer with broad experience in high-speed cinematography. Must be familiar with 16mm Eastman High-Speed Camera, Arriflex and Cine Special. Knowledge of time-lapse, standard motion-picture and still photography techniques also desirable. Training and experience will determine starting salary in \$6000 to \$9000 range with excellent growth opportunities in growing in-plant department. All replies confidential. Send resume to: Photography Dept., Corning Glass Works, Corning, N.Y.

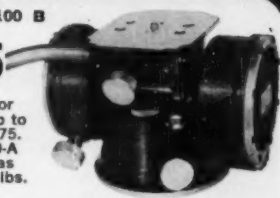
Television Broadcast Technician. Group stations offer opportunities for men with initiative and basic knowledge of TV fundamentals. Write G. G. Jacobs, Corinthian Broadcasting Corp., 302 So. Frankfort, Tulsa, Okla.

O'CONNOR Fluid CAMERA HEADS FOR SMOOTH CONTINUOUS EASILY CONTROLLED ACTION

MODEL 100 B

\$695

Model C for camera up to 20 lbs. \$275.
Model 200-A for cameras up to 200 lbs. \$2250



- Designed for use with 16 and 35mm. cameras with a total weight up to 100 lbs.
- Heavy duty professional model.
- Weighs 20 pounds. Dimensions: 7" high, 7" deep, 11" wide.
- Tilt from minus 75° to plus 75°.
- Camera mounting screw 3/8"-16.
- Equipped with precision bull's eye level.
- Available with Mitchell Standard, Mitchell 16, Pro Jr., Auricon and O'Connor "Level-head" bases.

WRITE FOR ILLUSTRATED BROCHURE

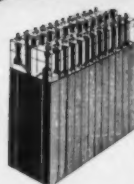
Serving the World's Finest Film Makers

FLORMAN & BABB, Inc.

68 W. 45th St., New York 36, N. Y.

MURRAY HILL 2-2928

F & B NICKEL CADMIUM BATTERIES



The perfect companion for your Arriflex, mounted in rugged aluminum case, with shoulder strap. Indestructible, high capacity Nickel Cadmium cells provide perfect power, absolutely guaranteed for 1 year.

7v. Battery (6 cells)	\$45.00
10v. Battery (8 cells)	100.00
15v. Battery (12 cells)	135.00
Voltmeter attach. (opt)	20.00
Ammeter attach. (opt)	10.00
Miniaturized Charger	29.50
NEW—15v-7 1/2v Battery—can be switched	
for 7 1/2v or 15v for both 16mm and 35mm	
Arris	\$155.00
With Built-In Charger	184.50



**FLORMAN
& BABB, Inc.**

68 W. 45th St., New York 36, N. Y.

MURRAY HILL 2-2928

SPECTRA 3-COLOR METER



**The ONLY
meter that
measures all
light sources,
including DAYLIGHT,
accurately!**

SPECTRA 3-color meter measures the proportionate amounts of all three primary colors present in the light source and indicates the filters necessary for positive color correction in Spectra Index Units. (*Kelvin Scale optional).

Write for descriptive literature
and complete specifications.



PHOTO RESEARCH CORP.

Karl Freund, A.S.C., President

837 N. Cahuenga Blvd., Hollywood 38, Calif.

500X MORE SENSITIVE!

The NEW Spectra "Combi-500" Professional Exposure Meter retains every advantage of the famous Spectra Professional! The "Combi-500" combines a SELENIUM CELL and NEW ULTRA-SENSITIVE PHOTO-CONDUCTIVE CELL. Sensitivity is 500 times that of the average selenium cell meter, 100 times more than the highly sensitive Spectra Professional Meter. Exposures are indicated for extremely low light levels. UNDER NORMAL LIGHTING CONDITIONS, THE STANDARD SELENIUM CELL OPERATES WITHOUT THE AID OF THE BATTERY.

SPECTRA®

"COMBI-500"

Professional
Exposure
Meter

PATENT
APPLIED FOR

NOTE: Convert your
Spectra Professional to
"Combi-500" at
nominal cost.



PHOTO RESEARCH CORP.
837 N. Cahuenga Bl., Hlywd. 38, Calif.
photometry is our business... not a sideline

Exchange Job—TV Cameraman. German TV cameraman in Munich, Germany, TV studio would like to exchange job for 1 yr with TV cameraman in New York, Washington or Philadelphia, including fully furnished apartment in beautiful section of Munich. Write: F. Sittl, München-Bogenhausen, Buschingstrasse 45 XII, Germany. Additional information in New York from: Ursula Heemann, 123 East 39 St., New York 16. YU 6-5478.

Film Technician. Competent, experienced man for technical evaluation of film and to maintain quality control in large film video-tape operation. Send resume and references to: Supervisor of Recording Services, WTTW, 1761 E. Museum Drive, Chicago 37, Ill.

Theatre Sound Engineer. Indian company requires sound engineer for theatre installation and service. Administrative and sales experience desirable. Please send resume and salary requirements in full confidence to: Cinefones, 3 New Queen's Road, Opp: Opera House, Bombay 4, India.

Television Specialists. Require professionals for planning, executing and operating closed-circuit mobile television equipment, and to direct work of other television specialists and technicians. Requires travel in United States. Send resume and inquiries to General Dynamics/Astronautics, P.O. Box 1128, Dept 130-60, San Diego 12, Calif. Attn: Warren B. Jones, Jr., Employment Mgr.

Motion-Picture Sound-Recording Engineers. Motion-picture unit, industrial, requires alert soundmen for staff. Must know all phases of sound recording, transferring, mixing and theory. Send resume and inquiries to General Dynamics/Astronautics, P.O. Box 1128, Dept 130-60, San Diego 12, Calif. Attn: Warren B. Jones, Jr., Employment Mgr.

Color Motion-Picture Printer with experience. Will consider related experience in film handling, negative splicing and other laboratory skills.

Motion-Picture Laboratory Technician with experience in 35mm color processing.

Filmstrip Cameraman. Fully experienced, familiar with Oxberry equipment. Able to work without supervision.

Color Timer for filmstrip laboratory, experienced. Salary open on all positions. Reply to: M.G., 68-46 Groton St., Forest Hills 75, N.Y.

Motion-Picture Equipment Maintenance and Repair Men. Experienced with Mitchell, Arriflex, etc. cameras, Movielas, projectors, lighting equipment, machine shop, optical and audio equipment. Good salary and opportunity. Florman & Babb, 68 West 45th St., New York 36.

Journals Available/Wanted

These notices are published as a service to expedite disposal and acquisition of out-of-print Journals. Please write direct to the persons and addresses listed.

Available

Index 1936-1945; Mar.-Sept., Nov., Dec. 1947; Jan., Feb., Sept., Nov., Dec., Index Jan.-June 1948; Jan., Mar. & High-Speed Photography, Apr.-July, Index Jan.-June, Sept.-Dec., Index July-Dec. 1949; Jan.-Oct., Dec., Indexes Jan.-Dec. 1950; Jan.-Apr., June, July, Sept.-Dec., Indexes Jan.-Dec. 1951; Jan.-July, Index Jan.-

June 1952; Jan.-Aug., Nov., Dec., Indexes Jan.-Dec. 1953; Jan.-June, Aug.-Dec., Indexes Jan.-Dec. 1954; Jan.-Dec. & Index 1955; Jan.-Dec. & Index 1956; Jan., Mar. 1957; Jan., Apr. 1958. Available as entire lot for \$100. Camille Buyse, 1232 Chaussee de Wavre, Auderghem-Brussels 16, Belgium.

Jan. 1936 through Mar. 1957, except Mar. 1942 and Jan. 1945. Send offer to: R. S. Parris, 29 Charles St., Natick, Mass.

Assortment of Journals, from 1937 through 1950. Write: Alan Cook, South Londonderry, Vt.

Complete set of Journals March 1937 through May 1954. Best offer. A. R. Ulmer, 69 Cresskill Ave., Dumont, N. J. DU 4-8656.

Complete set of Journals January 1949 through December 1960, inclusive, including high-speed, special issues, indexes, directories, etc., in excellent condition. For sale as entire lot only. Leslie Helhena, P. O. Box 643, Burbank, Calif.

Complete set of Journals from January 1934 through June 1960. Excellent condition. For sale only as a set. Write: Don Norwood, 1470 San Pasqual St., Pasadena, Calif.

Complete set of Transactions, except Nos. 6 and 9, and all Journals published to date, including indexes. All in good condition. Price \$500. Also extra copies of Transactions Nos. 21, 31, 32. W. W. Hennessey, RFD #2, Pound Ridge, N. Y.

Complete set of Journals from May 1937 to June 1954, including special volumes and membership directories, excellent condition; also Mar., May 1934 and July 1935 issues. Write: Harry R. Lubcke, 2443 Creston Way, Hollywood 28, Calif. HO 9-3266.

Jan.-Dec. 1950; Jan., Feb., Apr.-Dec. 1951; Jan.-Mar. 1952. Also available are vols. 6 and 7 of The Television Society (British) covering the period Jan. 1950 through Sept. 1955. Write: Andrew N. McClellan, 65 Hillside Drive, Toronto 6, Ont., Canada.

Dec. 1946, Feb.-Dec. 1947, 1948-1955 complete. All copies in perfect condition; for sale as entire lot only. Write: Joseph W. MacDonald, 2414 Sullivant Ave., Columbus 4, Ohio.

Jan. 1947 to Dec. 1957 complete and in perfect condition. For sale only as a set. Write: Charles J. Marshall, 2816 Royalston Ave., Kettering 19, Ohio.

Complete set of Journals Jan. 1949 to Dec. 1958. Perfect condition. What offers? Write: J. G. Jackson, 210 Kingsway South, Port Alberni, B. C., Canada.

Wanted

Jan., July, Sept. and Nov. 1949; Jan and Feb. 1950. Century Lighting, Inc. (Mrs. Levine), 521 W. 43 St., New York 36, N.Y.

Feb., Mar., Apr., June 1934. Mrs. Janet Van Duyen, Librarian, CBS Laboratories, 227 High Ridge Rd., Stamford, Conn.

Journals—Bound volumes. Write: S. P. Solow, Consolidated Film Industries, Inc., 959 Seward St., Hollywood.

Transactions 6 and 9 (\$15 each offered). W. W. Hennessey, RFD #2, Pound Ridge, N.Y.

Jan. 1938, Jan. 1949. (Many other issues are available for trade.) Dept. of Cinema, Univ. of Southern Calif., University Park, Los Angeles 7. Attn: Herbert E. Farmer.

Mar. 1939, May 1940, July, Feb. 1942, July 1949. V. E. Patterson, 2 North 30th St., Phoenix, Ariz.

The Society is grateful to the following authors for supplying translations: George E. Cummins, John R. Turner and Robert J. Wilson—*French, Spanish, German*; Paul A. Hermle and Harold D. Lowry—*French, Spanish German*; Jean De Backer—*French, Spanish, German*. Translations contributed by Alex Quiroga and Pablo Tabernero are also gratefully acknowledged.

Traitement rapide du film cinéma par l'application de couches visqueuses.
1^{re} Partie: Traitement du film cinéma avec des couches visqueuses.

GEORGE E. CUMMINS, JOHN R. TURNER et ROBERT J. WILSON [875]

On a inventé une méthode pour le traitement rapide des films cinéma par l'application de couches légères de solutions chimiques visqueuses. Les opérations de traitement se font dans un milieu saturé avec vapeur d'eau à une température élevée. La qualité physique et photographique du film positif noir et blanc traité par cette méthode est égale à celle obtenue par le procédé conventionnel. Les solutions chimiques employées pour ces traitements conservent leurs propriétés pendant longtemps sous des conditions normales. On évite les problèmes ordinaires de contrôle chimique, permettant ainsi l'opération automatique du système de traitement.

2^{ème} Partie: Appareil pour le traitement rapide des films 16mm.

PAUL A. HERMLE et HAROLD D. LOWRY [878]

C'est une machine pour le traitement rapide et simplifié des films positifs noir et blanc de 16mm. Elle emploie des couches légères de solutions visqueuses pour le développement et le fixage jusqu'à 52°C. Le film est traité à une densité et contraste contrôlés au préalable à une vitesse de 11 mètres par minute, la durée totale jusqu'au séchement étant 1 minute. On emploie des solutions en paquets, qui sont débitées au film d'un récipient dans la machine ayant une capacité pour 5 heures d'opération. Pour l'usage, les seules connections nécessaires sont l'électricité, de l'eau chaude et un moyen de drainage.

Niveaux d'images et contrôle en télévision "noir sur blanc"

HAROLD WRIGHT [882]

L'auteur examine l'engendrement des formes d'ondes d'image par les appareils de prise de scènes vivantes et les caméras de téléciné, ainsi que les principes de base des appareils de contrôle d'images et d'ondes. Ce mémoire indique le degré de standardisation de cette industrie en Amérique du Nord. Les méthodes de contrôle y sont décrites, et la nécessité d'un contrôle précis des voltages de pointe en pointe de l'image est justifiée en les considérant par rapport à la modulation de l'émetteur et de l'enregistreur à bande-images, à l'enregistrement du film, à la transmission du réseau et à la rétention des caractéristiques esthétiques de l'image entre la source d'émission et l'auditoire. L'auteur explique l'interprétation exacte de la présentation d'oscilloscope, passe en revue les références en "blanc sur noir" et examine la relation entre ces dernières et les tons et les reflets de surface. L'effet de l'opération du rognage blanc est considéré. Quelques recommandations sont données par l'auteur.

La "barre d'obturateur" dans l'enregistrement des films de télévision

C. H. EVANS [898]

La conversion de la cadence de 60 champs de

télévision par seconde à celle de 24 images de film par seconde dans l'enregistrement des films de télévision s'effectue généralement en supprimant de l'enregistrement le dernier demi-champ de chaque série de cinq demi-champs consécutifs. Il s'ensuit qu'il y a une collure de bande au centre de toutes les deux images de film. Dans une caméra munie d'un obturateur mécanique correctement réglé, tous les points de l'image reçoivent le temps total juste d'exposition. Toutefois, les rapports d'intensité et de temps d'exposition différent pour des points situés à l'intérieur et à l'extérieur de la collure de bande, ce qui peut entraîner une différence de densité en travers de la collure. Cette forme de "barre d'obturateur" a été éliminée dans le nouveau film expérimental d'enregistrement décrit par l'auteur.

Un microdensitomètre pour les recherches photographiques

FRANK P. HERRNFELD [904]

Un microdensitomètre a été conçu et réalisé selon un tracé sobre en vue de son emploi en recherches photographiques. Cet appareil a un pouvoir de résolution d'environ 850 lignes par mm lorsque l'ouverture de balayage a 1 micron de large et 40 microns de long. La réponse est linéaire jusqu'à 0,1% de transmission pour la même ouverture. En rétrécissant l'ouverture, le pouvoir de résolution peut être porté à un maximum de 2000 lignes par mm. On peut prendre des lectures visuelles sur un indicateur autonome ou l'on peut relever un enregistrement sur du papier graphique à coordonnées rectangulaires.

Un système de contrôle par mémorisation

JEAN DE BACKER [906]

Le fonctionnement des scènes (jeux de lumière sur les scènes) ou des studios de télévision devient trop compliqué pour l'opérateur, même avec les systèmes de présélection actuels. On utilise un équipement comprenant un pupitre de commande, des amplificateurs magnétiques pour contrôle à distance ou des redresseurs au silicium à électrode de contrôle, une mémoire électro-magnétique intermédiaire triple, une machine à cartes perforées et une machine à écrire répétitive normale, pour reproduire automatiquement tous les états lumineux déterminés au cours des répétitions. L'opérateur contrôle le transfert d'un état à un autre au moyen de boutons-poussoirs et transferts.

Proceso rapido de película cinematográfica mediante la aplicación de capas viscosas. Parte 1: Proceso de película cinematográfica mediante capa viscosa.

GEORGE E. CUMMINS, JOHN R. TURNER y ROBERT J. WILSON [875]

Se ha ideado un método para proceso rápido de la película cinematográfica que consiste en la aplicación de capas delgadas de soluciones químicas viscosas. El tratamiento químico se lleva a cabo dentro de una atmósfera saturada de

vapor de agua a temperatura elevada. La calidad física y fotográfica que se obtiene en la película positiva en blanco y negro que se procesa mediante este sistema es idéntica a la que se consigue por los medios de procesar ordinarios. Las soluciones químicas que se usan en conexión con estos tratamientos conservan sus propiedades, bajo condiciones de almacenaje normales, por períodos largos. Los problemas acostumbrados de control químico quedan eliminados por completo, cosa que permite el funcionamiento automático del sistema de procesar.

Parte II: Aparato para el proceso rápido de película de 16 mm.

PAUL A. HERMLE y HAROLD D. LOWRY [878]

Un aparato de estilo simplificado para el proceso rápido de película positiva blanco y negro de 16 mm. proporciona capas delgadas de soluciones viscosas para aquellos tratamientos de revelado y fijado, a temperatura de 52°C. La película se procesa a densidad y contraste precontrolados a una velocidad de accionamiento de 11 metros por minuto, y un período entre secado y secado de 1 minuto. Emplea soluciones químicas corrientes que dosifican la película desde un depósito situado dentro del aparato, con abastecimiento para 5 horas. Lo único que se necesita hacer es conectar la electricidad, agua caliente y facilidades de desagüe.

Monitor de televisión y niveles de video

HAROLD WRIGHT [882]

Se repasan las formas de onda generadas por cámaras de video en conjunto con las básicas maneras de monitorear tanto la imagen como las señales de video. Se da cuenta del grado de los standards de la industria de televisión en Norte America. Se discuten las formas de control. La necesidad de controlar rigurosamente los voltajes de video de cresta a cresta es justificada, si estos voltajes se consideran por un lado con relación al transmisor, a las modulaciones íntimas necesarias en las grabaciones de video tanto en banda magnética como en película, a la transmisión por radio-cadena y por el otro lado, sin perder la parte estética de la imagen desde el punto de origen en el estudio hasta finalmente en el receptor en el hogar. Se sugiere la interpretación precisa de osciloscopio, se consideran patrones de blanco y negro como referencia en relación a la rendición de los tonos faciales y resplandores. Se considera el efecto causado por limitar la señal a un 110%. Finalmente se ofrecen algunas recomendaciones. (Tr. Alex Quiroga)

Barra del obturador en grabaciones de video

C. H. EVANS [898]

Para convertir los 60 campos—o sea 30 cuadros por segundo—de un sistema de televisión, a razón de 24 cuadros por segundo necesarios para grabaciones de video con película, se lleva generalmente a cabo omitiendo del registro fotográfico cada quinto consecutivo medio

campo. Como consecuencia, cada otro fotograma de la película tiene un "empalme" atravesando el centro de la imagen. Si mecánicamente el obturador de la cámara está debidamente ajustado, todas las partes del fotograma serán expuestas a un total correcto. Sin embargo, la intensidad de la exposición y la relación de tiempo cambian en partes dentro y fuera del "empalme". Esto puede causar la barra de obturador por las diferencias de densidad a través del "empalme." Esta forma de barra de obturador se ha eliminado con una nueva película experimental que se describe en este artículo. (Tr.: Alex Quiroga)

Un microdensitometro para investigacion fotografica

FRANK P. HERRNFELD [904]
Se ha diseñado y construido, dentro de líneas simples, un microdensitometro para la investigación fotográfica. Tiene un poder de resolución de alrededor de 850 líneas/mm. con una abertura de barrido de 1 micrón de ancho y 40 micrones de largo. La respuesta es lineal hasta un límite inferior del 0,1% de transmisión para dicha abertura. Haciendo la abertura más estrecha, el poder de resolución puede aumentarse a 2000 líneas/mm. Las lecturas pueden tomarse visualmente en un instrumento de medición incorporado o puede obtenerse un gráfico sobre papel de coordenadas rectangulares. (Tr. Pablo Tabernero)

Un sistema de control luminoso por memorización

JEAN DE BACKER [906]
El funcionamiento de las escenas (juegos de luz sobre las escenas) o de los estudios de televisión llega a ser demasiado complicado por el operador, aun con los sistemas actuales de preselección. Se utiliza un equipo comprendiendo una consola de transmisión, amplificadores magnéticos por control a distancia o rectificadores de silicio con electrodo de control, una triple memoria electro-magnética intermedia, una máquina de cartas perforadas, una máquina de escribir a repetición normal para reproducir automáticamente todos los determinados estados luminosos en curso de repeticiones. El operador controla el traspaso de un estado a otro por medio de un botón a empujar y traspasamientos.

Schnelle Bearbeitung von Kinofilmen durch dickflüssige Beschichtung. Teil I: Entwicklung von Kinofilmen durch dickflüssige Beschichtung.

GEORGE E. CUMMINS, JOHN R. TURNER und ROBERT J. WILSON [875]
Es ist eine Methode zur schnelleren Bearbeitung

von Kinofilmen entwickelt worden durch die Auftragung dünner Schichten dickflüssiger chemischer Lösungen. Die chemische Behandlung wird bei erhöhter Temperatur in einer mit Wasserdampf gesättigten Atmosphäre durchgeführt. Die stoffliche und fotografische Qualität der nach dieser Methode entwickelten schwarz-weißen Positivfilme ist die gleiche wie von Filmen, die nach der üblichen Art entwickelt wurden. Die zu diesem Verfahren benutzten chemischen Lösungen erhalten ihre Eigenschaft über einen ausgedehnten Zeitraum der Lagerung unter normalen Verhältnissen. Die üblichen Probleme der chemischen Kontrolle sind beseitigt, wodurch das Entwicklungssystem automatisiert werden kann.

Teil II: Maschine für schnelle Entwicklung von 16mm Filmen.

PAUL A. HERMLE und HAROLD D. LOWRY [878]

Es handelt sich um eine schnelle, vereinfachte Entwicklungsmaschine für 16mm schwarz-weiße Positivfilme. Sie verwendet dünne Schichten einer dickflüssigen Lösung zum Entwickeln und Fixieren bei einer Temperatur von 52°C. Der Film wird zu vorgeprüfter Dichte und Schwärzung bei einer Geschwindigkeit von 11m per Minute und einer Trockenzeit von 1 Minute entwickelt. Verpackte chemische Lösungen werden dem Film in kontrollierten Mengen zugeführt von einem Materiallager innerhalb der Maschine, das Material für 5 Stunden fasst. Bei Gebrauch müssen nur Elektrizität, heisses Wasser und die Spülanlage bedient werden.

Fernseh-Absehen und Video-Niveau

HAROLD WRIGHT [882]
Die Bildung von Video-Wellenformen, wie sie bei den verschiedenen Fernsehkameras hergestellt werden, zusammen mit den Grundlagen Bild- und Wellenform zu ueberwachen, werden besprochen. Es wird eine Abfassung von der Industrienorm in Nord Amerika gegeben. Die uebliche Ueberwachungsanlagen werden durchgesehen. Es wird darauf hingewiesen, wie die maximalen Spannungs-Spitzwerte sehr genau kontrolliert werden müssen, wenn das Verhaeltnis von diesen Spitzwerten in Beziehung zu dem Sender, die Aufzeichnungsmodulation fuer Magnetisch- oder Filmaufnahmen und das gesammte Funknetz gebracht wird, und immer noch so das kuenstlerische Wert des Bildes von der Quelle bis zu dem Empfaenger beibehalten soll.

Besonders Nachdruck wird auf die richtige Uebersetzung des Oszillographs gemacht. Die Beziehung von Schwarz-und-Weiss Pegel in Verhaeltnis zu Gesichtsfarbung und Glanz ist erwaegt. Es werden einige Vorschlaege gemacht. (U/b. Alex Quiroga)

Umlaufblende-Strich in Fernseh-filmaufnahmen

C. H. EVANS [898]
Umsetzung von 60 Fernseh-Felder (30 Bilder) zu 24 Film-Bilder in Fernseh Filmaufnahmen, wird üblich so erreicht, dass jedes Fünfte aufeinanderfolgende halbes Fernseh-Feld einfach ausgelassen wird. Zur folge, jedes andere Film-Bild hat durch die Mitte des Bildes eine sogenannte "Klebe". Wenn die Umlaufblende in der Aufnahmekamera mechanisch einwandfrei eingestellt ist, alle teile des Bildes werden durchaus richtig belichtet. Jedoch, die Belichtungsmenge und die Relation der Zeit wechselt und das könnte zur verschiedenen Leuchtdichten durch die "Klebe" führen. Dieser Umlaufblendestrich wurde mit einem neuen Versuchsfilm, der hier besprochen wird, vermieden. (U/b. Alex Quiroga)

Ein Mikrodensitometer für die photographische Forschung

FRANK P. HERRNFELD [904]

Es wurde ein einfaches Mikrodensitometer für photographische Forschungszwecke entwickelt und gebaut. Sein Auflösungsvermögen beträgt 850 Linien/mm. mit einer Abtastöffnung von 1 Mikron Breite und 40 Mikron Länge. Sein Wiedergabevermögen ist linear bis zu einem Transmissionsgrad von 0,1% herunter für die angegebene Öffnung. Wenn man die Öffnung verschmälert, kann das Auflösungsvermögen bis auf 2000 Linien/mm. gesteigert werden. Die erhaltenen Werte können visuell von einem eingebauten Instrument abgelesen oder direkt als graphische Darstellung auf rechtwinkligem Koordinatenpapier erhalten werden. (U/b. Pablo Tabernero)

Ein Gedächtnis-Lichtkontrollsystem

JEAN DE BACKER [906]

Der Betrieb der Bühnen (Lichtspiele auf den Bühnen) oder der Betrieb der Fernsehstudios wird, sogar unter Ausnützung der jetzigen Vorwählsysteme, für den Bedienungsmann zu kompliziert.

Man verwendet eine Ausrüstung mit einem Bedienungspult, Magnetverstärkern für die Fernsteuerung oder Silizium-Gleichrichtern mit Steuer-Elektrode, einem elektro-magnetischem dreifachen Zwischengedächtnis, einer Maschine mit gelochten Karten und einer normalen Repeater-Schreibmaschine um alle im Laufe der Proben festgelegte Lichtzustände automatisch zu wiederholen.

Der Bedienungsmann steuert der Übergang von einem Zustand zum anderen mittels Druckknöpfe und Übertragungen.

Ed. Note: Titles and abstracts of all papers published in the *Journal* are published in French, Spanish and German. This department (Résumés/Resúmenes/Zusammenfassungen) was set up in recognition of the growth in the Society's overseas membership, and first appeared as a regular feature of the *Journal* in the January 1961 issue. Comments and suggestions are invited on the quality and possible improvement of the translations. Because of the prohibitive cost of commercial translations, volunteer help is needed, and such assistance will represent an important contribution to the Society. Contributors will, of course, be given full acknowledgment in the *Journal*.

News Columns

91st Convention and Equipment Exhibit	914	Current Literature	930
6th International Congress on High-Speed Photography	915	Books, Booklets, Brochures	932
Education, Industry News	916	Abstracts	934
SMPTE Elections	920	New Members	946
Obituaries: O. B. Hanson; Monroe Sweet	922	Trends in 70mm Projection Equipment, by Gio- vanni Bozzi	950
Section Reports	927	SMPTE Test Films	952
BOOKS REVIEWED	928	New Products	953
<i>Russian-English Dictionary of Science, Technology, and Art of Cinematography</i> , by Val Telberg, reviewed by George L. George; <i>English- Russian Dictionary of Photography and Cine- matography</i> , by A. A. Sakharov, reviewed by Alexis N. Vorontzoff.		Employment Service	957
		Journals Available/Wanted	958
		Résumés—Resumenes—Zusammenfassungen	959

Advertisers

Allen Products, Inc.	952	Magnasync Corp.	947
Arriflex Corp. of America	949	Magna-Tech Electronic Co., Inc.	937
Bach Auricon, Inc.	929	Marconi's Wireless Telegraph Co. Ltd.	933
Bausch & Lomb	953	Minnesota Mining & Mfg. Co.	935
Birns & Sawyer Cine Equipment, Inc.	955	Mole-Richardson Co.	922
Burke & James, Inc.	934	Motion Picture Laboratories, Inc.	930
Camera Equipment Co.	943, 944	Movielab Film Laboratories, Inc.	917
Camera Mart, Inc.	920, 948	Moviola Mfg. Co.	936
Clairex Corp.	927	O'Connor Engineering Laboratories	931
Employment Ads	920, 942	Pan American Films	938
Film Effects of Hollywood	951	Photo Research Corp.	958
Filmline Corp.	922	Prestoseal Mfg. Corp.	932
Florman & Babb, Inc.	928, 946, 957	Professional Services	954
General Film Laboratories, Inc.	921	SMPTE	914, 915
Gevaert Photo-Producten N.V.	939	S.O.S. Photo-Cine-Optics, Inc.	956
Hollywood Film Co.	941	Sylvania Electric Products, Inc.	919, 923-926
Lab-TV	950	Texas Industrial Films	940
La Vezzi Machine Works	952	Westrex Co.	918
Lenz Electric Mfg. Co.	945	Wollensak Optical Co.	916

Meeting Calendar

Society of Reproduction Engineers, Visual Communications Congress, Dec. 1-4, Hotel Biltmore, Los Angeles.	IRE International Convention, Mar. 26-29, 1962, New York.
AICE, Annual Meeting, Dec. 3-7, Hotel Commodore, New York.	Polytechnic Institute of Brooklyn, 12th International Symposium on the Mathematical Theory of Automata, Apr. 24-26, 1962, United Engineering Center Auditorium, New York.
American Association for the Advancement of Science, Annual National Meeting, Dec. 26-31, Denver Hilton, Brown Palace, Cosmopolitan, Shirley Savoy Hotels, Denver, Colo.	91st Semiannual Convention of the SMPTE and Equipment Exhibit, Apr. 29-May 4, 1962, Ambassador Hotel, Los Angeles.
Electronic Industries Association, Eighth National Symposium on Reli- ability and Quality Control, Jan. 9-11, 1962, Statler-Hilton Hotel, Washington, D. C.	Electrochemical Society, Annual Meeting, May 6-10, 1962, Statler- Hilton Hotel, Los Angeles.
ASME, Symposium on Thermophysical Properties, Jan. 22-26, 1962, Princeton Univ., Princeton, N. J.	SPSE Annual Conference, May 7-11, 1962, Somerset Hotel, Boston, Mass.
American Physical Society, Jan. 24-27, 1962, New York.	IRE, National Aerospace Electronics Conference, May 14-16, 1962, Dayton, Ohio.
AIEE, Winter General Meeting, Jan. 28-Feb. 2, 1962, Hotel Statler, New York.	AIEE, ARS, IAS, IRE, ISA, National Telemetering Conference, May 23-25, 1962, Sheraton-Park Hotel, Washington, D. C.
Institute of the Aerospace Sciences, Annual National Meeting, Jan. 29- 31, 1962, Hotel Astor, New York.	6th International Congress on High-Speed Photography, Sept. 17-22, 1962, Hotel Kurhaus, Scheveningen, Netherlands.
Society of the Plastics Engineers, Annual Technical Conference, Jan. 30-Feb. 2, 1962, Penn-Sheraton Hotel, Pittsburgh, Pa.	92nd Semiannual Convention of the SMPTE and Equipment Exhibit, Oct. 21-26, 1962, Drake Hotel, Chicago.
AICE, National Meeting, Feb. 4-7, 1962, Statler-Hilton, Los Angeles.	93rd Semiannual Convention of the SMPTE and Equipment Exhibit, Apr. 21-26, 1963, Traymore Hotel, Atlantic City, N. J.
American Society of Photogrammetry, Annual Convention, Mar. 11-17, 1962, Washington, D. C.	94th Semiannual Convention of the SMPTE and Equipment Exhibit, Oct. 13-18, 1963, Somerset Hotel, Boston.
American Chemical Society, National Meeting, Mar. 20-29, 1962, Washington, D. C.	

SMPTE Officers and Committees: The rosters of the Officers of the Society, its Sections, Subsections and Chapters and of the Committee Chairmen and Members were published in the April 1961 Journal.

sustaining members

of the Society
of Motion Picture
and Television Engineers

The objectives of the Society are:

- Advance in the theory and practice of engineering in motion pictures, television and the allied arts and sciences;
- Standardization of equipment and practices employed therein;
- Maintenance of high professional standing among its members;
- Guidance of students and the attainment of high standards of education;
- Dissemination of scientific knowledge by publication.

Progress toward the attainment of these objectives is greatly aided by the financial support provided by the member companies listed below.

Acme Film Laboratories, Inc.
Alexander Film Co.
Alex Laboratories Cinematograficos S.A.
Altec Service Company
Altec Lansing Corporation
American Broadcasting-Paramount
Theatres, Inc.
ABC-TV Network
ABC Films, Inc.
Ampex Video Products Company
Animation Equipment Corp.
Ansco
Arriflex Corp. of America
C. S. Ashcraft Mfg. Company, Inc.
The Association of Cinema
Laboratories, Inc.
Association of Professional Cinema
Equipment Dealers of New York
Camera Equipment Company, Inc.
The Camera Mart, Inc.
Florman & Babb, Inc.
S.O.S. Photo-Cine-Optics, Inc.
Atlas Film Corporation
Audio Productions, Inc.
Bach Auricon, Inc.
Bausch & Lomb Incorporated
Beckman & Whitley, Inc.
Bell & Howell Company
Bonded Film Storage
(Division of Novo Industrial Corp.)
Brooks Camera & Supply
Byron Motion Pictures, Inc.
S. W. Caldwell Ltd.
Calvin Productions, Inc.
Capital Film Laboratories, Inc.
Oscar F. Carlson Company
Cellomelic Company of Canada
Division of Peelfcraft Ltd.
Century Lighting, Inc.
Century Projector Corporation
Cineffects, Inc.
Cinesound, Ltd., Canada
Geo. W. Colburn Laboratory, Inc.
Color Reproduction Company
Color Service Company, Inc.
Columbia Broadcasting System, Inc.
CBS Television Network;
CBS Television Stations; CBS News;
CBS Films; Terrytoons
Commonwealth-Filmcraft Laboratories
Pty. Ltd.
Comprehensive Service Corporation
Consolidated Film Industries
DeFrees Company
DeLuxe Laboratories, Inc.
Desilu Productions, Inc.
Du Art Film Laboratories, Inc.
Tri Art Color Corporation
E. I. du Pont de Nemours & Co., Inc.
Eastern Effects, Inc.
Eastman Kodak Company

Edgerton, Germeshausen & Grier, Inc.
Edisco, Inc.
Elgeet Optical Company, Inc.
Max Factor & Co.
Fairchild Camera & Inst. Corp.
Industrial Products Division
Famous Players Canadian
Corporation, Ltd.
Field Emission Corporation
Filmline Corporation
Dr.-Ing. Frank Fröding GmbH
GPL Division of General Precision, Inc.
General Electric Company
General Film Laboratories
W. J. German, Inc.
The Gevaert Company of America, Inc.
Guffanti Film Laboratories, Inc.
Frank Hermsfeld Engineering Corp.
Hi-Speed Equipment Incorporated
Hollywood Film Company
Hollywood Film Enterprises, Inc.
Houston Fearless Company
Philip A. Hunt Company
Hunt's Theatres
Hurletron Incorporated
JM Developments, Inc.
The Jam Handy Organization, Inc.
Jarnieson Film Co.
The Kalart Company Inc.
Victor Animatograph Corporation
Keltz & Herndon, Incorporated
KIN-O-LUX, Inc.
Kollmorgen Optical Corporation
Labcraft International Corporation
Laboratoires Cinématographiques
C.T.M.
LAB-TV
Robert Lawrence Productions, Inc.
Lipsner-Smith Corporation
Lorraine Arc Carbons,
Division of Carbons, Inc.
M.G.M. Laboratories, Inc.
McCurdy Radio Industries, Ltd.
Mecca Film Laboratories Corporation
D. B. Milliken Company
Minnesota Mining & Manufacturing Co.
Mitchell Camera Corporation
Mole-Richardson Co.
Monaco Laboratories
Monteleoni, Inc.
Motion Picture Association of America,
Inc.
Allied Artists Pictures Corporation
Buena Vista Film Distribution Com-
pany, Inc.
Columbia Pictures Corporation
Metro-Goldwyn-Mayer, Inc.
Paramount Pictures Corporation
Twentieth Century-Fox Film Corp.
United Artists Corporation
Universal Pictures Company, Inc.
Warner Bros. Pictures, Inc.

Motion Picture Enterprises, Inc.
Motion Picture Laboratories, Inc.
Motion Picture Printing Equipment Co.
Movielab Film Laboratories, Inc.
Moviola Manufacturing Co.
National Carbon Company, Division of
Union Carbide Corporation
National Screen Service Corporation
National Theatre Supply Company
Neumade Products Corporation
W. A. Palmer Films, Inc.
Pan-American Films
Panavision Incorporated
Parthenon Pictures
Pathé Laboratories, Inc.
Pathé-DeLuxe of Canada, Ltd.
Peerless Laboratories of Canada, Ltd.
Photo-Animation, Inc.
Photo-Sonics, Inc.
Pittsburgh Motion Picture Lab
Precision Laboratories
(Division of Precision Cine Equipment
Corporation)
Prestoseal Mfg. Corp.
Producers Service Company,
Division of Boothe Leasing Corp.
RCA Victor Company, Ltd.
Radio Corporation of America
National Broadcasting Company
Broadcast and Television Equipment
Division
Rank Precision Industries Ltd.
G. B. Kaale Division
Rapid Film Technique, Inc.
Reid H. Ray Film Industries, Inc.
Reeves Sound Studios, Inc.
RIVA-Munich
Charles Ross Inc.
Russell-Barton Film Company
L. B. Russell Chemicals, Inc.
Ryder Sound Services, Inc.
Shick Safety Razor Company
Research Laboratories
(Division Eversharp, Inc.)
Bruce J. Sclievers, Consulting Engineer
Scripts By Oveste Granducci, Inc.
Smith, Kline & French Laboratories
Snazelle Productions, Inc.
Southwest Film Laboratory, Inc.
The Strong Electric Company
Sylvania Electric Products, Inc.
Technicolor Corporation
TELIC, Incorporated
Titra Film Laboratories, Inc.
Traid Corporation
Trans-Canada Films Ltd.
Van Praag Productions
Westinghouse Electric Corporation
Westrex Corporation
Wilding Inc.
Wollensak Optical Company

The Society invites applications for Sustaining Membership from other interested companies. Information may be obtained from the Chairman of the Sustaining Membership Committee, Ethan M. Stifle, Eastman Kodak Co., Room 626, 342 Madison Ave., New York 17, N.Y.

